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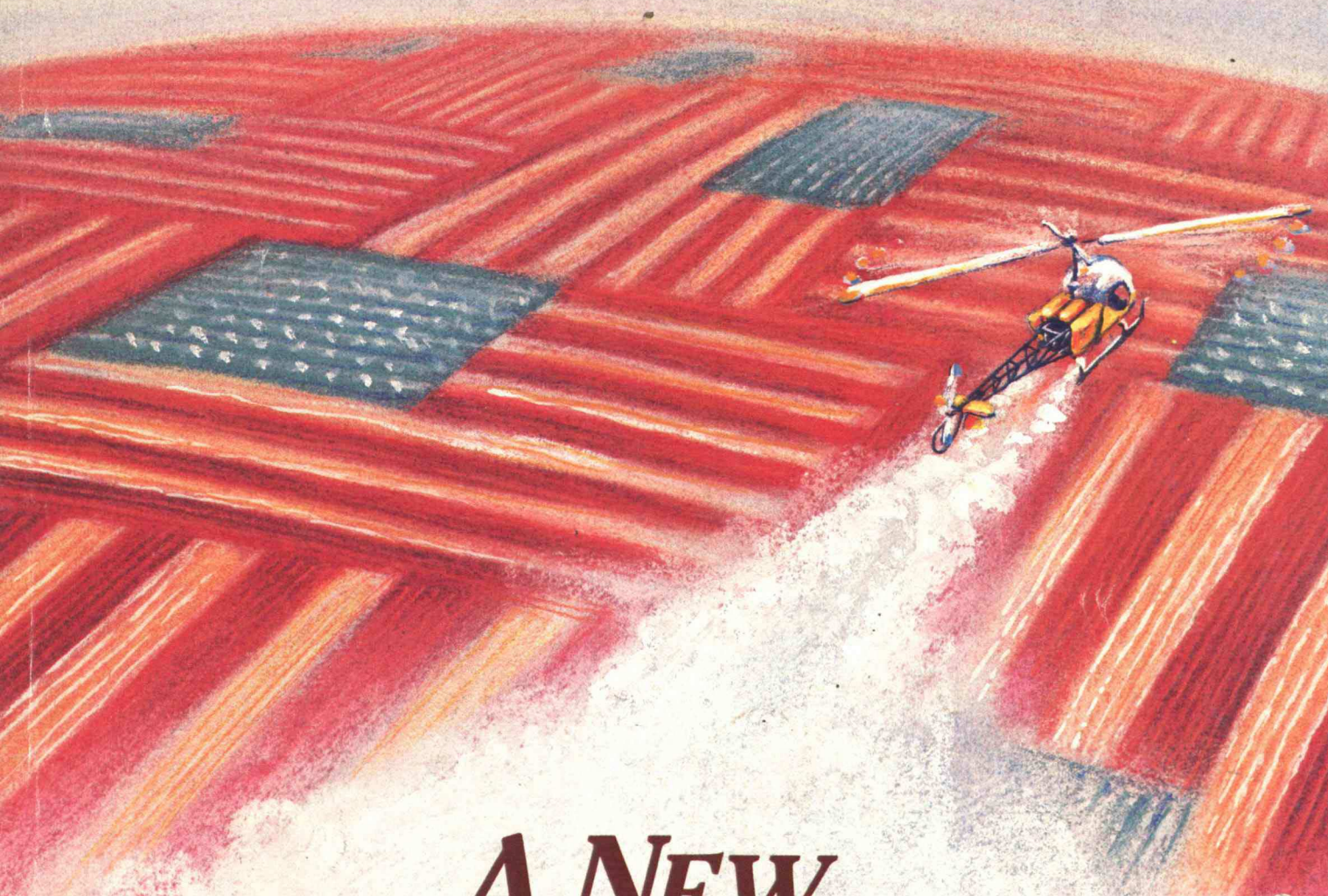
CHEMICAL WEAPONS DEBATE: TWO VIEWS

Technology Review

EDITED AT THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY NOVEMBER/DECEMBER 1985 $3.00



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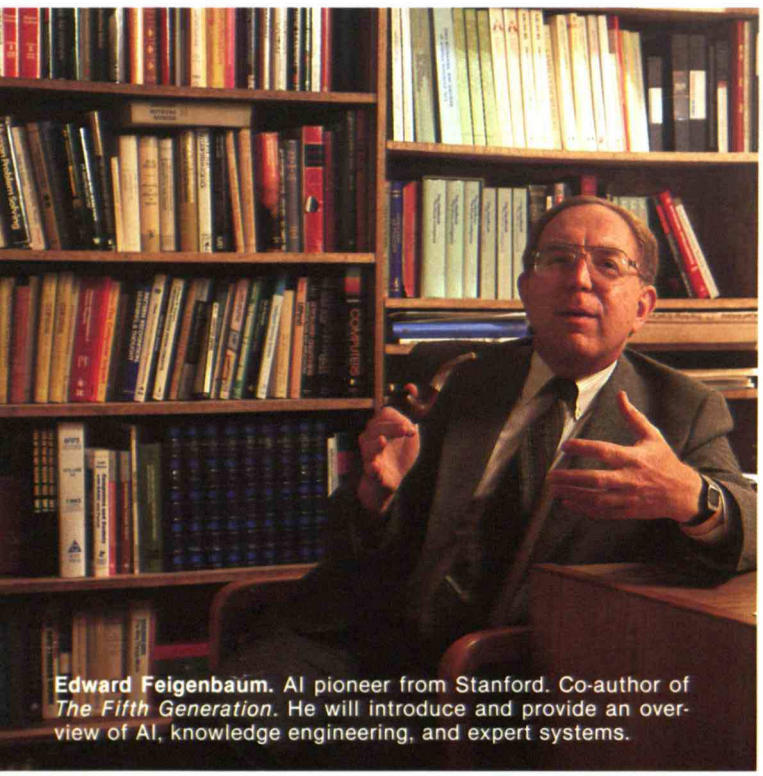
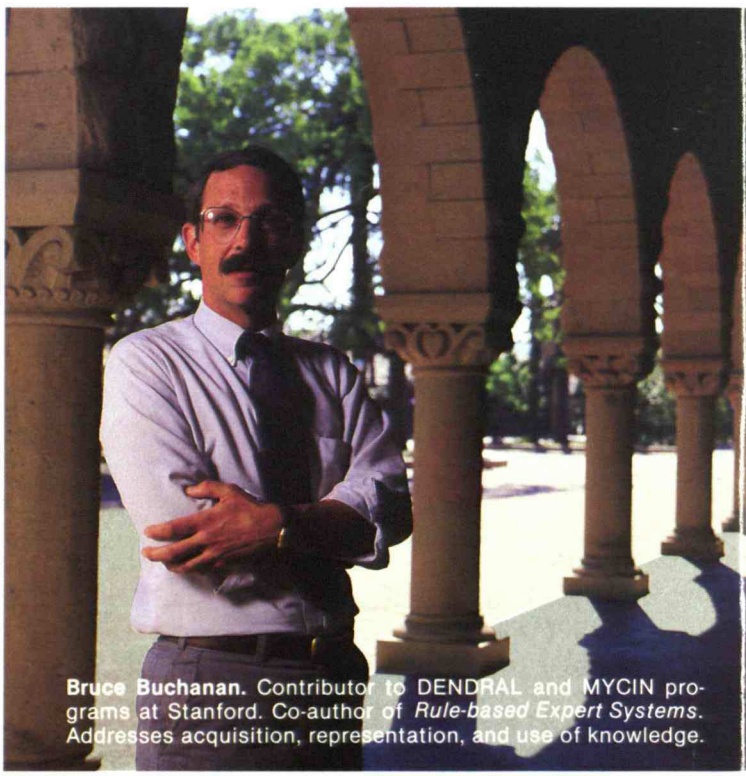
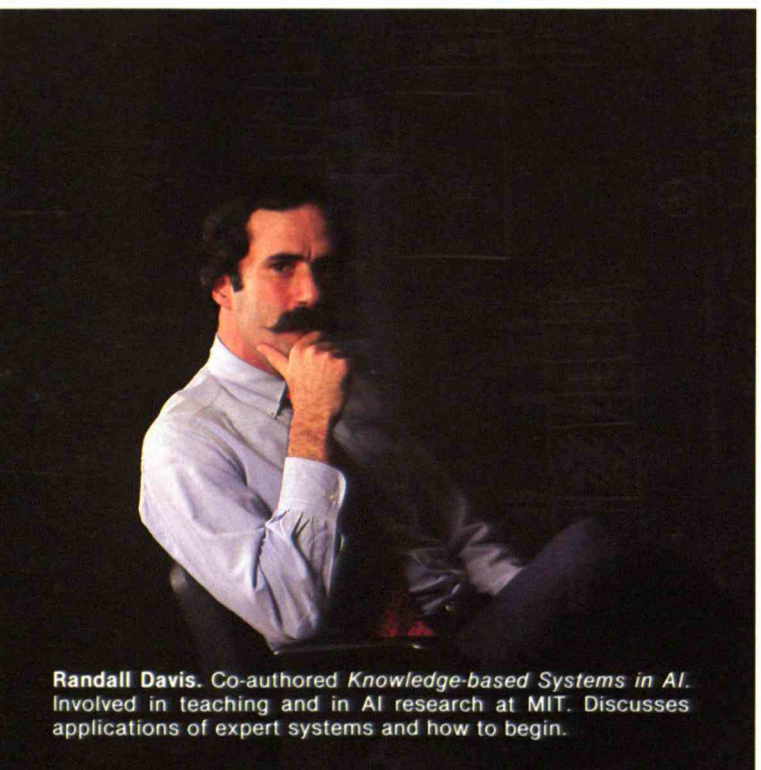


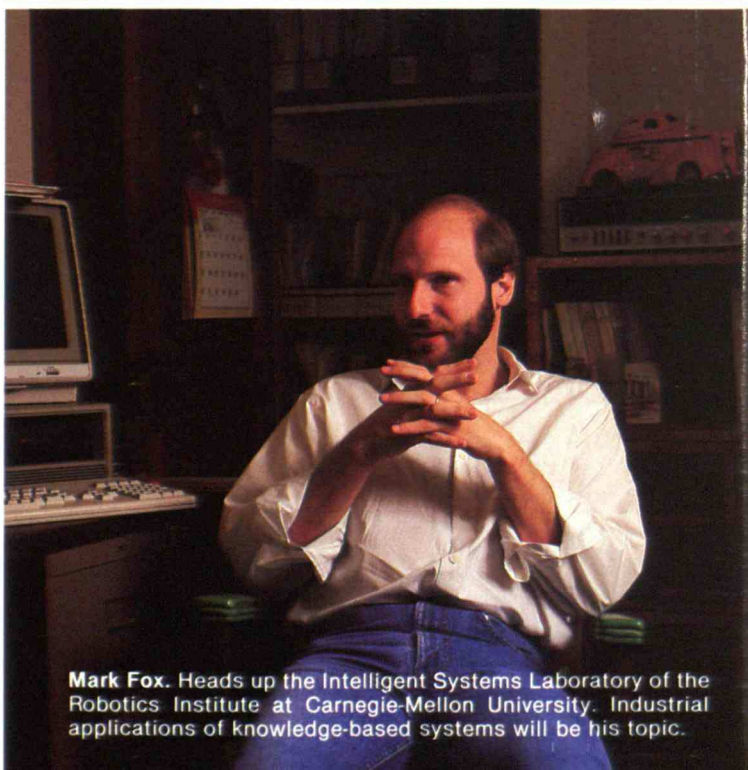
Edward Feigenbaum. AI pioneer from Stanford. Co-author of *The Fifth Generation*. He will introduce and provide an overview of AI, knowledge engineering, and expert systems.



Bruce Buchanan. Contributor to DENDRAL and MYCIN programs at Stanford. Co-author of *Rule-based Expert Systems*. Addresses acquisition, representation, and use of knowledge.



Randall Davis. Co-authored *Knowledge-based Systems in AI*. Involved in teaching and in AI research at MIT. Discusses applications of expert systems and how to begin.



Mark Fox. Heads up the Intelligent Systems Laboratory of the Robotics Institute at Carnegie-Mellon University. Industrial applications of knowledge-based systems will be his topic.

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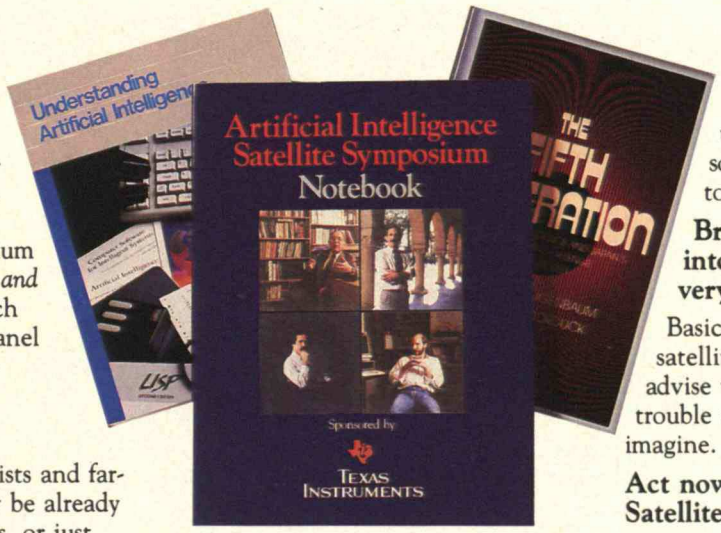

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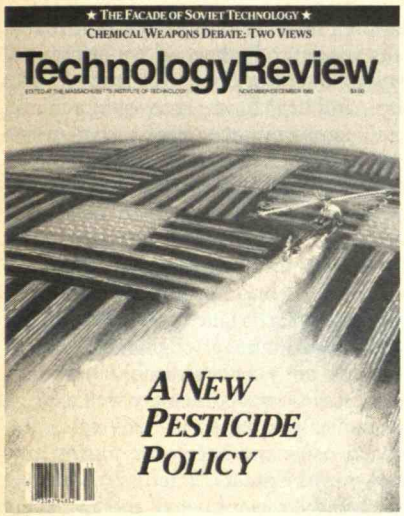

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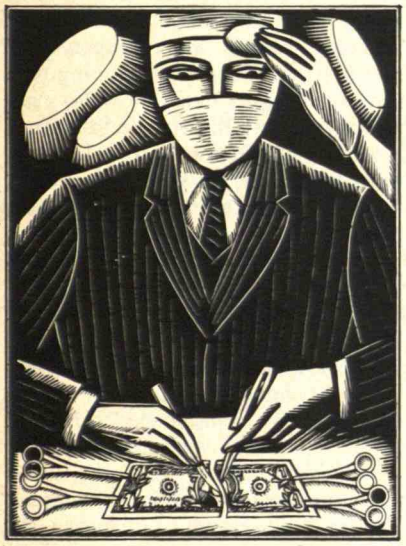

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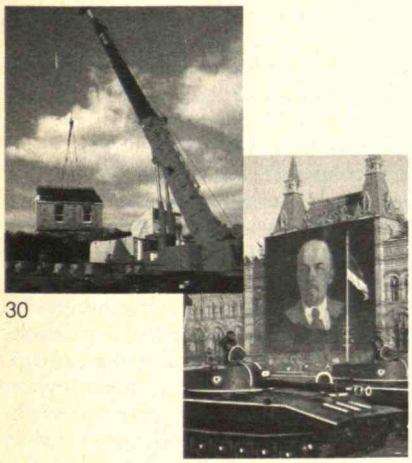

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Health-Care Costs, Conventional Arms, and Advanced Robots

Cutting Health-Care Costs

In "An Antidote for Soaring Health-Care Costs" (*April, page 6*), Lester Thurow writes, "The free-market system is a way of saying 'no,' but doing so in a very inegalitarian way. Since the richest 20 percent of all U.S. households has 11 times as much income as the poorest 20 percent, any efficient market mechanism will end up giving 11 times as much medical care to the top 20 percent as it gives to the bottom 20 percent.' "

According to this statement, the rich have exactly the same spending patterns as the poor. Thurow has allowed his ideological bent to get in the way of his undoubted knowledge of elementary economics.

F. Eugene Davis IV
Stamford, Conn.

Lester Thurow's article is an excellent review of a trying situation for payors, patients, and physicians. As physicians, we must be financially accountable for the tests and treatments we order. However, I would like to emphasize two key points regarding cost containment.

As Thurow points out, the distinction between "ethical non-treatment" (my term) and neglect and malpractice must be made clear. Also, the legal system must recognize this distinction. Otherwise, doctors will continue to practice defensive medicine by ordering extensive treatment.

Second, I have not yet come across any analysis of the costs of capital equipment and supplies for the health-care system. Medical equipment and supplies are fearfully expensive. Hospitals and physicians have traditionally passed these costs along to third-party payors. I suspect that there are more than a few $600 hammers floating around in the system. Isn't it time we looked into this?

Edward R. Ringel
Chicago, Ill.

Lester Thurow is correct: we are an egalitarian society in which all patients have near-equal opportunity for care. I firmly believe in such egalitarianism. Thurow is also right in saying that arbitrary age cutoffs for intensive care and for elective surgery are inappropriate.

But I disagree with Thurow's assumption that we cannot afford a health-care budget that increases faster than overall economic growth. How can we afford our ballooning military budget? Does it really buy us security? Perhaps if we spent less on weapons and more on education, art, science, and health care we would achieve greater security: we might win more friends and influence more people worldwide, and produce better educated, motivated, and trained soldiers at all levels. In addition, money spent on health care and basic research could create jobs and stimulate the economy.

Furthermore, the true costs of illness are difficult to estimate. If engineers salaried at $36,000 per year are disabled for four months, their lost income may well exceed their medical expenses. In this case, the most expensive and aggressive testing and therapy may be most cost-effective for patients, for their employers, and for society—though not necessarily for medical insurers. A corollary is that an incorrect diagnosis leads to the most costly care. Thus, better trained (more "expensive") doctors may save money in the long run. Health-care budgets must allow for new technology as well. Insurers and planners look only at their immediate liability. It certainly is cheaper for *them* to let the ill die quickly rather than to employ new forms of treatment and rehabilitation.

Finally, physicians cannot place philosophical considerations above their responsibility to individual patients. Expensive tests may seem unnecessary, but there is always a chance that the results will prove more enlightening than expected.

Richard P. Handler
Saranac Lake, N.Y.

Lester Thurow's counsel for revamping the health-care system to decrease expenditures is characteristically wise. But I take issue on two counts.

First, I am not sure that doctor-imposed controls on treating the hopelessly ill are practical given the legal, social, and professional pressures in our society. Nor am I sure that the federal government can enforce controls in the face of special-interest groups.

Second, I take issue with the discussion of health-care expenditures and the gross national product. While health care consumes 11 percent of GNP, it is responsible for producing the same percentage. Indeed, had it not been for increasing health-care expenditures in the seventies, unemployment would have been much higher, and GNP might not have increased at all. Also, while I agree wholeheartedly with

Thurow that we would do well to expend more GNP to improve industrial productivity and rebuild our cities and their services, there is no way to assure that redistribution will in fact occur following cuts in health-care expenditures.

Ross Markello
Buffalo, N.Y.

From Conventional Weapons to Nuclear War

Michael Klare's "NATO's Improved Conventional Weapons" (*May/June, page 34*) is a valuable contribution to the understanding of conventional as well as nuclear war. A key part of deterrence is convincing your enemy that if all else fails, you are willing to use your weaponry. Tactical nuclear weapons are therefore a questionable deterrence against conventional attack. Can NATO convince the Soviets that it will use nuclear weapons to fight off a conventional attack, thereby risking Soviet nuclear attack? Can the United States convince the Soviets that it will use nuclear weapons in Europe and risk attack on the American homeland? Deterrence can succeed only if it is credible.

Bruce Brager
Arlington, Va.

Usually what starts a war is not what keeps it going. War is more than a carefully planned enterprise that can be halted at any time by a telephone conversation between heads of states. Those who give certain orders have difficulty backing down. Once the machinery of war is set in motion, it is hard to stop.

Donald Carl
Boston, N.Y.

Advanced Robots

In "Who Said Robots Should Work Like People?" (*April, page 59*) Warren P. Seering implies that the domain of robotics is exclusively industrial. However, what Seering and others call "robots" are no more than programmable manipulators. Such manipulators have two or three degrees of freedom, no sensory feedback, a simple microprocessor controller, and a claw for an "end effector." Moreover, probably only a few sensors would be used on any one manipulator in the applications Seering considers. These sensors would be tailored to the tasks the manipulator would perform.

More advanced manipulators are unnecessary in industry today. Factories are controlled environments where machines are built into the floors and walls. Adding programmable machine tools and even sophisticated manipulators merely advances conventional automation. In contrast, a semi-autonomous vehicle used outside the factory will need highly developed sensors for navigation and manipulation. These vehicles will require what I would call real robotics capability.

Seering says that "humans are designed to throw stones, pick berries, and climb trees." Are we to take this to mean that robots may never achieve such capabilities, or that to develop such capabilities in robots is silly? Using robots to harvest citrus fruit has been seriously considered. And automated sheep shearing has been shown to be feasible. Robots that could climb trees would be close cousins of ro-

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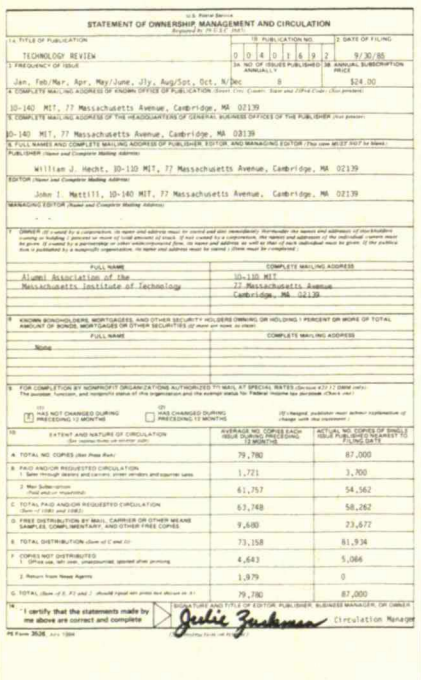

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bots used to build steel-girdered buildings or structures in space. As for throwing stones, is there a more natural way to move objects in zero g? Throwing could even be useful in manufacturing.

Supporting technologies could help scientists develop true robots. Tele-operators and programmable manipulators are an obvious example. Advanced hardware suited to sensory processing, symbolic processing, and real-time control is another component. A third is human-machine interfacing.

Tele-operators with realistic sensory feedback could be used to repair and recover components in space, exploit undersea minerals, and decommission nuclear power plants. Such uses would push true robotics technology into domains previously thought impractical. Who said robots should work like assembly lines?

Richard B. Amster
New York, N.Y.

Investing in Basic Research

In "Rethinking Our Approach to Science and Technology Policy" (*April, page 11*), Christopher Hill defines basic research as "the disciplined search for knowledge and understanding without regard to the utility of the results." He further suggests that very little basic research is being done in the United States.

In the past 30 or more years, definitions of basic research by both academia and industry have dropped any qualifying clause indicating whether the researcher has utility of results in mind. What counts is whether the findings are publishable in a journal that knowledgeable people recognize as a basic-research publication. I know Nobel laureates who did have utility in mind and others who didn't. One finds important contributions by scientists and engineers from both industry and academia in the recognized basic-research journals in many fields.

Later Hill states that "not until the National Science Foundation (NSF) was established in 1950 did federal support for basic research become widely accepted." Two things bother me about that statement. First, it was the Office of Naval Research (ONR) in 1946 that first promoted wide acceptance among universities and industry of federal funding of basic research. M.I.T. was among the first universities to contract with ONR that year. Second, I object to Hill's use of the word "support."

Over the past few decades many documents—both official and unofficial—have used the term "support" for basic research. The word connotes either promoting particular interests or propping up—as in "keeping the sick from fainting." No wonder Congress is wary of supporting research. The proper word is "investment." We must invest in basic research because we expect future returns from the knowledge we develop and the people we train.

Bruce S. Old
Concord, Mass.

The author responds:
Bruce S. Old's letter accents the limitations of using categories such as basic research, applied research, and development in view of the fact that there is no agreement on the definitions in science policy. He correctly observes that, in their working definitions of basic research, scientists frequently drop the phrase indicating whether they have utility of results in mind. Nevertheless, the official definitions used to gather data and guide policies on R&D activities do contain such a phrase. For example, *The Measurement of Scientific and Technical Activities,* a manual published by the Organization for Economic Cooperation and Development, defines basic research as "experimental or theoretical work undertaken primarily to acquire new knowledge of the underlying foundation of phenomena and observable facts, *without any particular application or use in view*" (emphasis added). Definitions of basic research adopted by the National Science Foundation and the Bureau of Census contain similar disclaimers of commercial objectives. If researchers and policymakers use different definitions of basic and applied research, how can they have a satisfactory dialogue regarding, for example, the proper roles of industry and the Federal government in supporting each category?

While expenditures for R&D are reasonably considered as investments in the future, it has been public policy for over 30 years to give firms the option to treat them as current expenses for tax purposes. In either case, Federal "support" for R&D seems well-established and free of the connotation of weakness or dependency that concerns Old.

Jackie West (white coat), Industrial Safety Engineer, and other Sun employees who are volunteer firefighters in Marcus Hook, Pa.

SUN, SAFETY AND THE VOLUNTEERS. At a moment's notice, Jackie West is ready to trade his Sun safety helmet for that of a fire captain. He's just one of the Sun people from our Marcus Hook, Pennsylvania, refinery who serve their local communities as volunteer firefighters.

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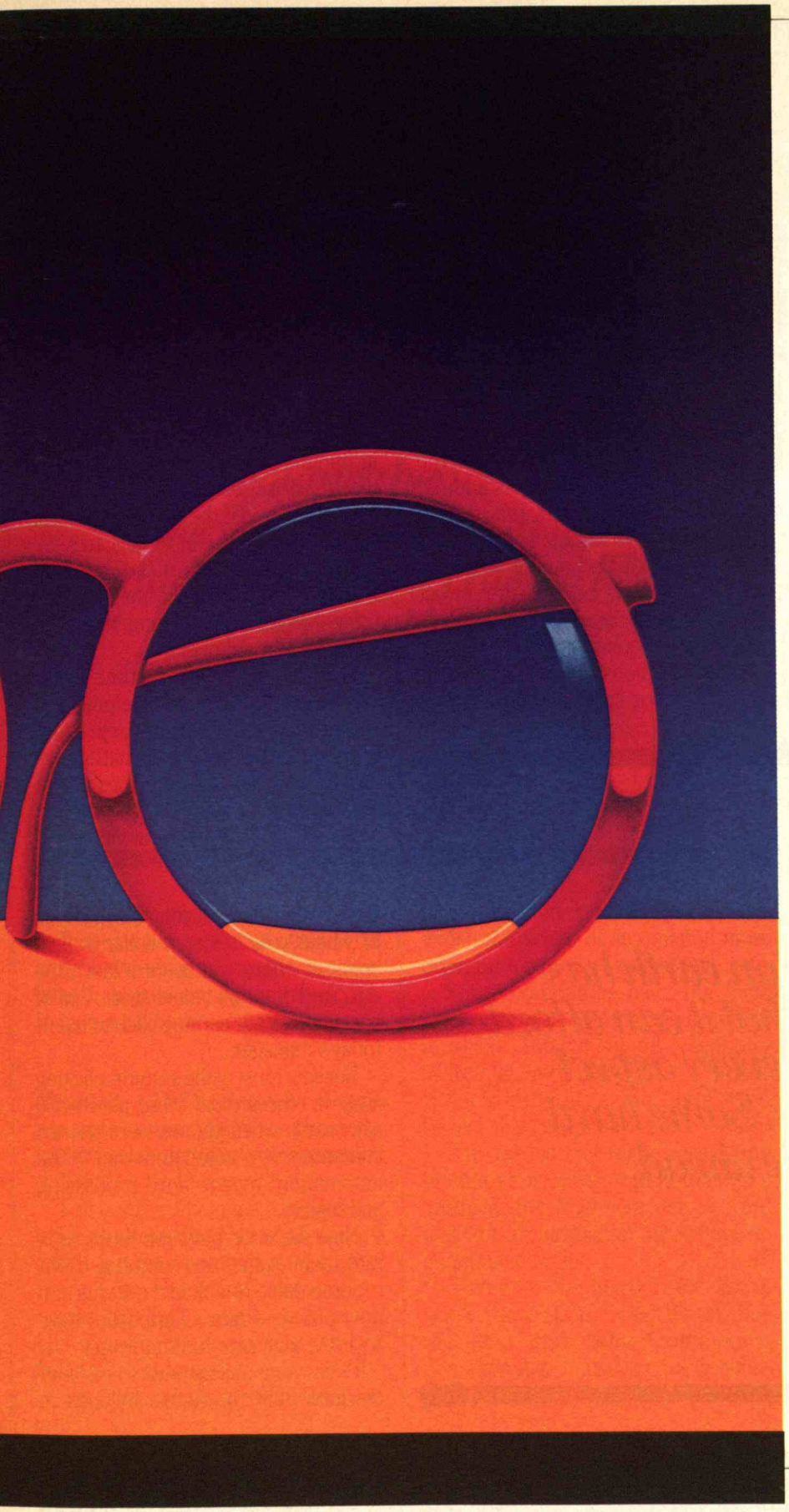

OFFICE AUTOMATION: HOW MUCH IS TOO MUCH?

Sometime last year American business crossed a technological Rubicon. For the first time in our history, capital investment per office worker exceeded that per factory hand.

Like it or not, information has finally surpassed material goods as our basic resource.

Walter Wriston, ex-Citicorp chief, likens information to a new form of capital, one that is arguably "more critical to the future of the American economy than money capital."

Every day brings news of faster, smaller, more capable devices to serve the 70% of us who now work with this new form of capital.

But while the trend spotters on

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their mountaintops cheer this "Second Industrial Revolution," the view from the front lines is not so rosy.

Too often, new devices are an uneasy fit with their sister machines of just a year ago. Too often, systems intended to simplify office life have the opposite effect. Grouses one manager: "The more business machines we buy, the more we seem to need."

Change is rampant. The stakes are high. Confusion is king.

◇

RASCALS. The best way to make sense of all this technology may be to ignore the whole business for a week or so and think about how your office works instead.

Who uses what kind of information? Where does it come from? What do they do with it?

No company on earth has pockets so deep that it can afford to automate every aspect of its business. Some hard choices lie ahead.

Item: In a typical office, 75% of the salary dollars go to managers and professionals. The system that spares these expensive rascals from a morning meeting or an hour of returning phone calls may be a better investment than one that does a whole day's work for someone else.

Item: The lion's share of time spent in any office is spent *communicating:* listening, talking, chasing down stray facts, dealing with mail.

Were you to keep a log, you'd be appalled by how little time you have for actually producing "work." (Par for senior executives: about 15%.)

To leverage time, look for ways to *move* information more efficiently.

A desktop computer can perform in minutes the spreadsheet analyses that used to gobble hours. But how much is gained if the figures still walk from office to office in a mail cart?

Item: Streamlining the internal workings of your office may be less profitable than automating ties with customers or suppliers.

Japanese style "just in time" deliveries from suppliers are helping U.S. automakers slash inventory costs. Computerized flight information systems have given some airlines a strategic advantage with travel agents.

No company succeeds alone.

◇

BALANCE. Complicating the question of where your systems dollar is best spent is where you spent it last time out. And the time before that. A lot of past choices are coming back to haunt today's manager.

Reason: most of the systems clicking away in offices today were purchased a la carte – when phones were phones, computers were computers, and "office automation" meant word processing and copiers.

Now the walls between these separate technologies are tumbling down.

Some office telephone systems can now process data. Computers have evolved that can communicate.

It's dawning on customers and vendors alike that the future belongs to

No company on earth has pockets so deep that it can afford to automate every aspect of its business. Some hard choices lie ahead.

> ***Today's customer must strike a balance between making the most of what's on hand and fighting like crazy to keep next year's options open.***

the *integrated* business system.

Today's customer must strike a balance between making the most of what's on hand and fighting like crazy to keep next year's options open.

◇

MISSING LINKS. Between today's a la carte systems and the office-wide, integrated everything of tomorrow is . . . what?

For many companies, the missing links are *networks.* By permitting different kinds of computers and other devices to share information, networks can pull today's stand-alone business machines into organized "islands" of automation.

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A plug for the home team: Every vendor does some things better than the other guys. While communications and data networks are drawing-board doodles in some shops, they are bread and butter items at AT&T.

It may be AT&T's greatest strength that we can integrate new and existing systems whether we provide *all* of those systems, or *some* of those systems, or the bridges between them.

◇

SUCCESS. Like the first Industrial Revolution, this one will lift some companies and confound others.

Those without a coherent plan to manage information in *all* its forms – the spoken word, thoughts on paper, images, and computer data – will be at a disadvantage.

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P.S. Much of this message was drawn from *The Integration Puzzle,* a two-day seminar offered by AT&T's Institute for Communications and Information Management. For further information or for a catalogue of AT&T Seminars in eight cities, please telephone 1 800 247-1212.

Or write Mr. Dale Hegstrom, AT&T Information Systems, P.O. Box 1405, Morristown, NJ 07960-1405.

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ROBERT C. COWEN

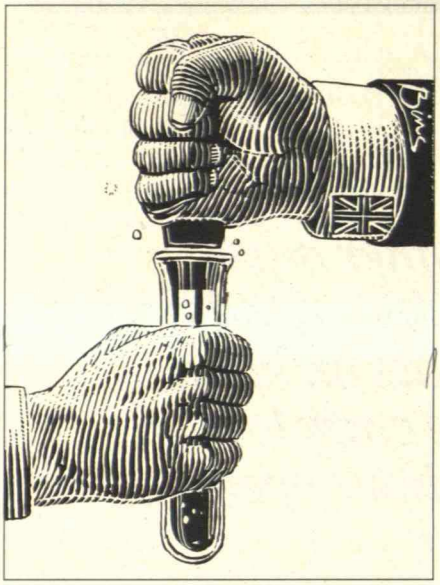
What We Can Learn from Britain's Scientific Decline

THE science news from Britain is gloomy. For the past three or four years, the British government has been cutting back on funds for basic university research at the rate of 1 or 2 percent each year. More recently, a government-sponsored committee recommended that Britain drastically cut its participation in CERN, the leading high-energy physics research center based in Geneva, Switzerland. According to this committee, British science is so financially pinched that it must virtually opt out of high-energy physics.

It would be sad enough to see Britain's scientific strength decline. But as is already evident with CERN, the country may export its malaise as it seeks to cut or even cancel some of its international research commitments. Britain was a founding partner in CERN and has played a major role in its success. Yet the committee headed by Sir John Kendrew, a Nobel laureate molecular biologist and president of St. Johns College, Oxford, has suggested that Britain withdraw from CERN in five years. The committee sees this as the only alternative unless CERN's other European members agree to let Britain reduce its £37.9 million annual subscription by 25 percent. Yet such a cut could cripple the laboratory that has made most of the major discoveries in particle physics over the past decade.

The Kendrew committee does not stop there. In what seems like a desperate plea, it asks the rest of the world to slow down its research too, saying that "it would not be counter to the long-term interests of the field if the pace could be reduced worldwide and not merely at CERN." That's a lot to ask of high-energy physicists when they believe they are about to break through to a level of understanding that may provide the long-sought unity of electromagnetic and nuclear forces.

Britain's struggle to find an affordable science policy also deserves world attention because it raises some universal issues. To what extent, for instance, should government seek to dictate the focus of university research and education? The crisis in Britain also raises questions about the proper role of universities in furthering a particular government's policies.



The British government has embarked on a self-defeating course in cutting back basic research.

Redirecting Research

The British government channels support for university research through a two-tiered system. The University Grants Committee (UGC) provides funding for faculty salaries, work space, and basic equipment in all fields. The Science and Engineering Research Council (SERC) and several smaller councils allocate funds for specific research projects. SERC supports roughly the kind of work funded by the National Science Foundation and the Department of Energy in the United States.

Britain's cutbacks in research have less to do with limited funds than with changing priorities in a civil science budget that runs to £582 million annually. A key priority of the current government is to make higher education and university research more responsive to the needs of British industry. Government leaders say they are trying to reshape an antiquated research structure to meet the growing—and in some cases overwhelming—challenge of industrial competition from abroad.

Accordingly, the Thatcher government has redirected research council funds toward "economically useful" projects such as work on information technology. At the same time, the government has cut UGC funding by 1 or 2 percent a year. As a result, the number of nontenured university staff has been reduced, and tenured faculty are being encouraged to retire after age 50. Indeed, the government is moving to virtually abolish tenure: it is expected to seek authority to rewrite university charters so that new faculty contracts would allow for dismissal because of incompetence, or even because of funding cuts. The research councils are also cutting back heavily on basic-science projects, laboratory equipment, and technical staff.

This summer, the government published a policy paper that promises to exert more such pressure on universities. In it, for instance, government officials suggested that the UGC place more emphasis on science and technology curricula and cut back on the arts and humanities. The diversion of funds to universities that are strong in science and technology could well mean the closing of one or more institutions over the next five years. The paper also recommended that universities work more closely with British businesses, and even suggested that promotions be based partly on the extent of faculty members' outside consulting.

This attitude has understandably alarmed many in Britain's academic community. In an essay for the British magazine *New Scientist*, R.J.P. Williams of Oxford University charged that the government seems to have lost sight of the fact that universities exist to produce thinking people—not material wealth. Williams warned that the country is risking its future by discouraging the education of creative generalists, and by treating universities as tools of economic policy.

It is hard to quantify the damage British basic research has sustained so far. But signs of the problems that Williams foresees are emerging. The Science Policy Unit at the University of Sussex has documented a continuing decline in the publication of British research results, and in the citation of British work by scientists elsewhere. John Harvey-Jones, chairman

Continued on page 76

ROBERT C. COWEN IS SCIENCE EDITOR OF THE CHRISTIAN SCIENCE MONITOR *AND FORMER PRESIDENT OF THE NATIONAL ASSOCIATION OF SCIENCE WRITERS.*

ILLUSTRATION: CHRISTOPHER BING

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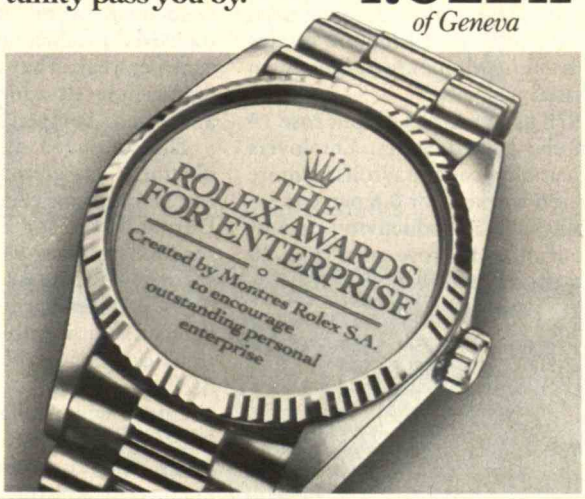


LESTER C. THUROW

Pruning Our White-Collar Ranks: A Key to Productivity

PARTICIPATORY management and decentralized decision making are usually sold as devices that will enhance labor's involvement, and hence its productivity. The real productivity gains, however, are not to be found on the factory floor, but in the cuts that can be made in the huge white-collar staffs now needed to keep American industry humming.

Suppose, for instance, that blue-collar workers take inventory at the end of their shifts, as they do in many Japanese auto plants. This procedure may give workers some variety and increase their motivation. But larger productivity gains will come from the fact that the company will no longer have to hire a staff of white-collar workers to monitor the parts that have been used and to make sure the needed parts are available for the next day's work.

Suppose that shop-floor workers are allowed to investigate the merits of alternative machine tools, and to order what seems best to meet their needs. These workers then have an incentive to prove that they made the best choice by showing how productive their new equipment is. But again, the real productivity gains will come from the much smaller staff of industrial engineers needed to order new equipment.

Indeed, if one examines the productivity problem in U.S. industry, one will find the heart of the problem not on the factory floor but in the office. In 1984, U.S. companies employed 57 million white-collar workers and only 29 million blue-collar workers. Since there are almost twice as many white-collar workers as blue-collar workers, productivity must rise among professionals. The problem becomes even greater if one adds the 14 million service workers, many of whom are indirectly on U.S. industrial payrolls.

From 1978 to 1984, real output rose 14 percent in the United States. Employers trimmed their blue-collar payrolls by more than 2 million workers, or 6.6 percent. As a result, blue-collar productivity, or output per hour of work, rose more than 20 percent—a good performance.

LESTER C. THUROW IS GORDON Y BILLIARD PROFESSOR OF MANAGEMENT AND ECONOMICS AT THE SLOAN SCHOOL OF MANAGEMENT AT M.I.T.

Our productivity problem lies in the office, not on the factory floor.

But this gain was almost completely wiped out by a decline in white-collar productivity. White-collar employment rose by more than 10 million, or 21.5 percent, and thus productivity actually fell—by 7.5 percent. This decline destroyed much of the gain in blue-collar productivity and yielded an overall increase in American industrial productivity of less than 1 percent per year. That is far below the 3 to 5 percent levels achieved by our European and Pacific competitors.

The continued rise in white-collar employment has given us the weakest post-recession recovery in productivity ever. During 1984, for example, real output rose 6.8 percent, but the employment of accountants rose 12 percent, and the hiring of private-sector managers increased 8 percent. With employment rising faster than output, productivity could only decline.

Larger white-collar overheads contribute to the cost disadvantage suffered by many American firms. About 40 percent of the cost advantage of producing a car in Japan, for example, can be traced to lower white-collar overheads.

At one time, critics could argue that government regulations were to blame for swollen private-sector white-collar bureaucracies. But those arguments are no longer convincing. The last decade has seen a lot of deregulation, but white-collar bureaucracies have continued to grow rapidly. Foreign firms, such as the Japanese auto companies, have shown that they can operate plants in the United States with much smaller white-collar staffs than their American counterparts.

The problem stems from the U.S. philosophy of management, which holds that the best manager is the one who has the most information and makes the most decisions. Events and underlings must be monitored on a day-by-day, if not minute-by-minute, basis. But this approach requires an enormous number of white-collar workers to do the monitoring and generate the information needed to make those decisions. Middle-level managers spend more time reporting than they do managing.

An alternative philosophy is to communicate very clearly the goals of the company, and then rely on lower-level workers and managers to make most of the operating decisions. Executives do not constantly monitor events and underlings, and meetings occur much less often. This system eliminates the functions that many white-collar workers perform.

The Difficulty of Eliminating Oneself

U.S. companies have lately done a lot of talking about the need to reduce their white-collar overheads. Yet they are continuing to hire even more such workers. Why?

The answer can be most clearly seen by looking at a similar problem in another context. The U.S. armed forces are now just one-sixth as large as they were during World War II, yet the United States has as many generals and admirals as it did during the war. Why hasn't the military cut back on generals and admirals? The answer is easy. Officers who do so cut back on promotion opportunities for themselves or people just like themselves.

Every reduction in managers and support staff down the economic ladder means that fewer managers are needed up the economic ladder. Furthermore, it is much easier to give an order to fire un-

ILLUSTRATION: LES KANTUREK

known blue-collar workers than it is to personally fire one's own secretary.

But there are other obstacles. To make participatory management and decentralization work, top executives have to function in very different ways. Their job becomes one not of making decisions but of setting strategic directions and communicating corporate goals so clearly that underlings can make the decisions.

The personality type required for this kind of management is quite different from the type that traditionally gets to the top. Many high-level U.S. executives become managers because they want to make a lot of decisions; they want to be the "boss," not a facilitator.

To make a system of participatory management work, the top managers of any firm should have extensive experience in daily operations so they can develop an intuition for solving problems without a lot of reports. However, given the rapid turnover that occurs in the executive suites of many U.S. firms, and the fact that top managers often come up from sales and finance, most don't know much about operations. They are familiar only with pieces of papers with numbers on them. As a result, there is a natural inclination to order more of that kind of reality, and to hire more white-collar workers to supply it.

Thus, executives practice defensive management in the same sense that doctors practice defensive medicine. Managers order reports, like tests, to protect themselves in case something goes wrong. That way managers can always claim that someone else wrote the report that dismissed the scenario that ultimately occurred.

As most firms have discovered, the real problems in setting up participatory management do not revolve around reluctant or incompetent workers. The problems stem from the changes required in managerial suites. To say that the armed forces ought to reduce the number of generals is easy. To be the general that reduces the number of generals is very difficult.

The standard American solution would be for top management to set numerical limits on the number of white-collar workers, but that is exactly the approach that got us into the problem in the first place. Executives are going to have to get down into the trenches and practice participatory management if they sincerely want to reduce the white-collar bureaucracy. □

SAMUEL C. FLORMAN

Forward into the Past Using High Technology

When a team of divers discovered a sunken Spanish galleon loaded with treasure off the Florida Keys in July, the event created predictable waves of excitement. Stacks of silver ingots brought up from the bottom of the sea, wooden chests spilling over with gold coins—these images tickle our national psyche, nourished as it is on get-rich-quick schemes, lotteries, and TV game shows. The American public was equally enthralled by the more recent discovery of the *Titanic*, the luxury ocean liner that sank to the bottom of the sea 73 years ago. The hunt for both the *Titanic* and the 400-year-old Spanish galleon appealed to our love of adventure, admiration for ingenuity, and insatiable curiousity. And, of course, the archeological significance of the galleon find is enormous, evoking enthusiastic reactions from scientists and historians.

"It sounds like a spectacular find," said George Bass, director of archeology for the Institute of Nautical Archeology at Texas A&M University. "It is a special thing to find an intact cargo that can give a picture of seventeenth-century exploration in the New World."

As an engineer, I find myself thinking about the technologies that helped make these discoveries possible—side-scanning sonar; the high-speed magnetometer, a meter that locates ferrous metals magnetically; and, in the case of the *Titanic*, low-light underwater TV cameras. I am especially intrigued by the thought that so much newly developed technical equipment is being used to recover the past.

People usually associate engineering progress with the future. In the slogans of celebrations (such as the annual Engineers' Week sponsored by the National Society of Professional Engineers) and the titles of engineering meetings, the dominant theme is often "the world of tomorrow" and "the years ahead." Charles Franklin Kettering, the long-time head of G.M. Research Corp., expressed a typical engineer's view when he wrote, "We should all be concerned about the future because we will have to spend the rest of our lives there."

New technology is helping us recover and preserve prized objects from the past.

Who would have guessed that one of the most interesting things about the future would be the knowledge we gain about the past? The experiences awaiting us in the years ahead will rival a trip backward on H.G. Wells' time machine.

The bottom of the seas contains an incredible wealth of information about the past, most of which has heretofore been beyond our reach. Since manned submersible craft are not considered safe beyond a depth of about 12,000 feet because of the crushing pressure, half of the ocean floor—which in its deepest trenches falls to more than 35,000 feet—has been hidden from view. But new undersea robots that use bright searchlights, remote-controlled television, photography, and sonar-mapping systems were crucial to the success of the joint French and American expedition that found the *Titanic*. These submersible robots, developed for use by the U.S. Navy, will probably also be used to pierce the inky darkness of the ocean depths on other archeological expeditions.

The surface of the earth, of course, contains archeological treasures that we have not even begun to explore. Ancient cities hidden in the jungles and under desert sands are waiting to reveal their secrets to newly developed aerial photographic techniques, as well as to satellite photography and mapping.

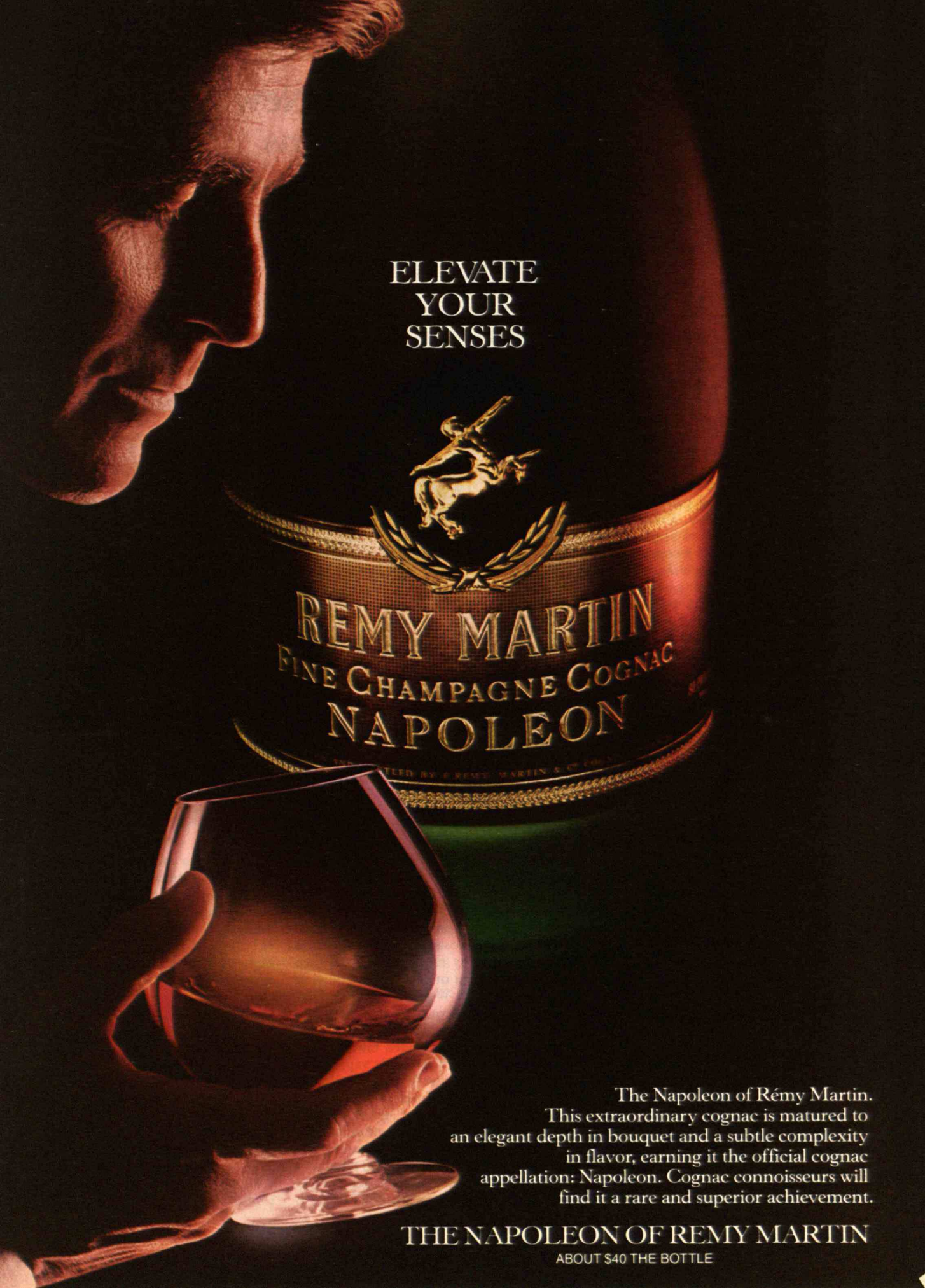
It seems paradoxical to speak of technology in terms of discovering the past, not only because we usually connect technology with the future, but also because technology has a reputation for destroying our heritage of art, architecture, social tradition, and natural environment. There can be no denying that technical progress often entails damage to things of value. But perhaps we have been underestimating the extent to which engineers have helped to preserve and recover prized objects that would otherwise be lost forever.

Much has been written about how chemicals in the air attack and destroy works of art, but we would do well to remember how chemical science is used to clean and restore paintings, and how x-rays and dating techniques add to our knowledge about the origins of art. Many museums and libraries use sophisticated air-conditioning systems to control humidity and temperature, forestalling "natural" decay. Photography and other reproduction techniques have saved priceless works—from cave paintings to medieval illuminated manuscripts—for future generations.

The conflict between the destructive and restorative functions of technology is vividly illustrated in Venice. There airborne acids from nearby industries are eroding statues and buildings. At the same time scientifically trained curators ply their restorative crafts, and tide gates keep stormy seas from destroying the city altogether.

Will technology discover more than it destroys? As in so many matters, that depends upon what we as a society decide to do. If we pursue the past only when the prize is gold and silver, the net result will surely be a loss. Our quest must continue far beyond treasure-laden ships. However, come to think of it, a Spanish galleon is an outstanding find. In addition to material wealth and archeological wonders, it carries a striking moral: a civilization that puts too high a value on the pursuit of gold—as did Spain in the sixteenth and seventeenth centuries—is not destined to survive in the fierce tides of history. □

ILLUSTRATION: PAUL FISCH



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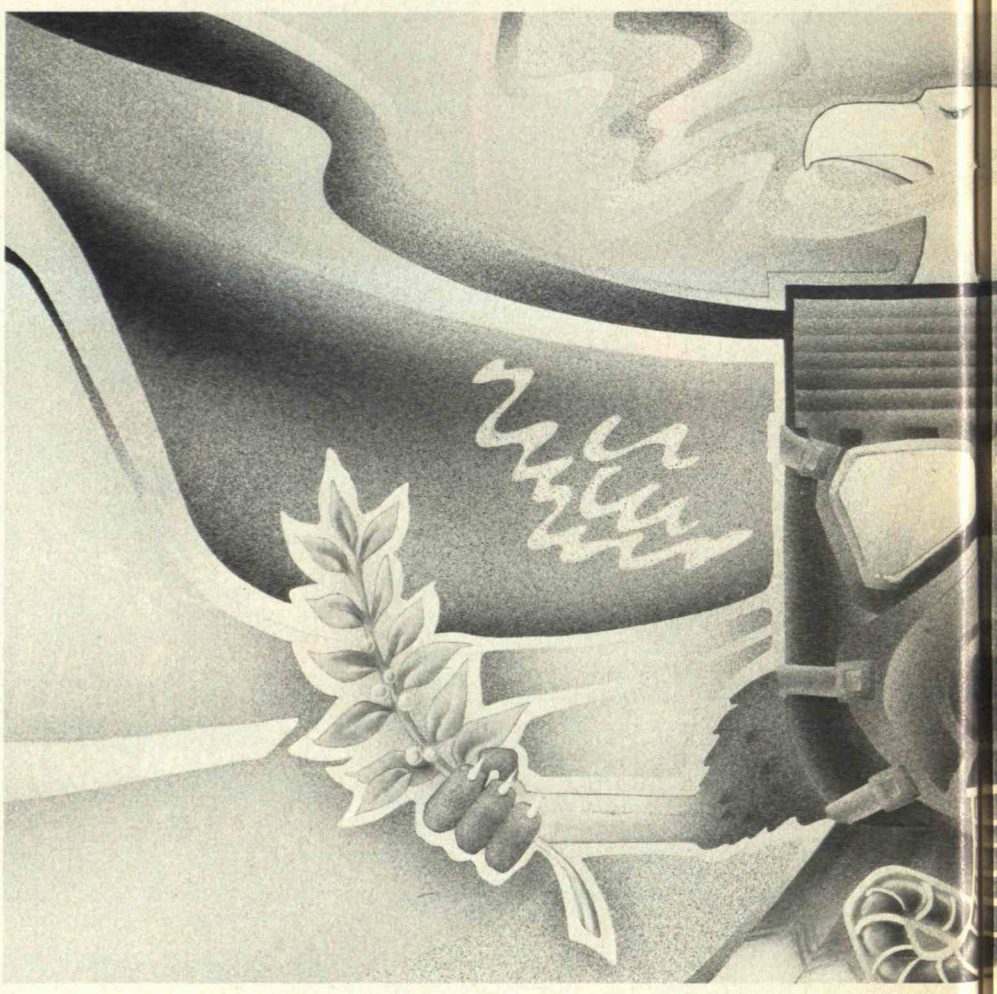
BY ROBERT J. RUTMAN

The Case Against New Chemical Weapons



UNTIL this year, the U.S. Congress, led by the House of Representatives, fought off 15 annual Pentagon campaigns to resume chemical weapons production. The prevailing congressional attitude seems to have been that chemical weapons have little, if any, military usefulness. Hence, there has been no real advantage in modernizing our chemical stockpile. Furthermore, the idea of chemical warfare has long been abhorrent, particularly to the nations that remember its heinous effect on soldiers during World War I. Our European allies have consistently objected to the storage of chemical weapons on their land, which is where they would be deployed.

But now, almost as if galvanized by a declaration of emergency, Congress has authorized $155 million to begin producing new binary chemical weapons. These weapons will consist of two chemicals that alone are unsuitable as war gases but when mixed together are lethal. Packed inside an artillery shell, these chemicals will be separated by a partition that breaks when the shell is fired. This allows the chemicals to react and generate nerve gas during the missile's flight toward its target. The weapons, which will also come in the form of aerosol sprays and bombs, are intended to replace our aging stockpile of unitary chemical weapons.

Undermining Chemical Disarmament

I believe that in funding this new generation of weapons, Congress has seriously undermined the chances for chemical disarmament and jeopardized our relations with other NATO countries. There is no evidence that the Russians have been developing their own binary chemical weapons. However, now that we have voted to build such weapons for use in Europe, the USSR will have to consider upgrading its own arsenal. Furthermore, it will be far more difficult to verify cutbacks in chemical weapons at a time of massive and mutual rearmament.

Why then has Congress suddenly decided to add hundreds of millions of dollars to the federal deficit in a year of general budget cutting? What changes have occurred in the international political scene to justify the use of such weapons?

Chemical weapons such as mustard gas, chlorine, and phosgene were first used in World War I, by the Germans and then the Allies, killing or maiming millions of soldiers. Early in World War II, the Germans invented nerve gases that were 100 to 1,000 times more toxic than the World War I gases. They included tabun, sarin, and soman, all highly volatile vapors that disperse quickly. After World War II, U.S. and British scientists developed VX, a more toxic and persistent nerve agent. All these newer gases are lethal in quantities of 1 to 10 milligrams, in contrast to mustard gas, for instance, which requires 500 times that amount to kill. These gases affect humans when either inhaled or absorbed through the skin. They work by inhibiting the action of a key enzyme, acetylcholine esterase, that is essential to the transmission of chemical messages from nerve cells to virtually all muscles in the body. Muscle paralysis follows, causing death by asphyxiation. In non-lethal doses, these agents can produce partial paralysis, dizziness, vomiting, and diarrhea.

Today the U.S. stockpile contains mustard gases, which blister and burn the skin, sarin, and the nerve gas VX. This stockpile consists of tens of thousands of tons of gases, either in bulk quantities or in artillery shells and bombs. The stockpile contains enough gases to blanket the Soviet Union and kill all its citizens—or, if administered individually, to provide 1,000 lethal doses for every person on earth.

Nerve gases are so dangerous that any

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ROBERT R. RUTMAN is professor of biochemistry and molecular biology at the University of Pennsylvania's School of Veterinary Medicine in Philadelphia. He is also chairman of the Scientists' Committee on Chemical and Biological Warfare, a national organization.

BY JOHN W. WARNER

The Case for Modernizing Our Chemical Weapons

ILLUSTRATION: MICHAEL YOUNG

One of the most controversial aspects of the U.S. defense program has been the administration's plans to modernize our arsenal of chemical weapons. To deter chemical warfare, this country must have the ability both to defend itself against chemical attack and to retaliate. While Congress has generally recognized the need to maintain a retaliatory force of chemical weapons, not until this year were both houses convinced that the existing U.S. stockpile of chemical munitions is no longer adequate.

As a result, Congress has authorized $155 million to begin replacing the current stockpile of chemical weapons with a new generation known as "binary" weapons. Binary munitions are safer to store and handle than the existing unitary weapons because they contain two inert chemical substances that are lethal only when mixed together upon firing. Unitary munitions, in contrast, contain a chemical agent that is already toxic.

The unitary weapons now in the U.S. stockpile are between 16 and 37 years old, and there are signs that they are deteriorating. Some of these munitions, like the M-55 rocket, have actually leaked toxic chemicals. As a result, they pose an increasing hazard to our military personnel who must handle them. Furthermore, most of these weapons are obsolete or in the form of munitions for which we have no means of delivery. For example, there are 500,000 M-55 chemical rockets and many 105-millimeter chemical artillery shells in the U.S. stockpile, yet we no longer have M-55 rocket launchers and 105-millimeter artillery pieces in Europe, where they would be needed.

Even the few stockpiled munitions still in good condition have limited use. They can be used only as short-range systems; we have no effective way of attacking longer-range Soviet targets. The binaries program will provide an improved 155-millimeter artillery round, a multiple-launch rocket system that reaches beyond short range, and the BIGEYE bomb, which aircraft can carry long distances.

In a December 1984 report, a committee of the National Academy of Sciences concluded: "About 90 percent of the inventory of chemical agents and nearly as much of the munitions inventory has little or no military value and will require disposal regardless of future decisions regarding the binary weapons programs." Recognizing the limited value of the current stockpile and its safety problems, Congress has directed that it be destroyed as binary munitions are produced. The deadline for its disposal is 1994, five years sooner than originally planned.

Soviet Advantage

According to our senior military leadership, the lack of a credible chemical deterrent is the most serious weakness in our conventional defense posture. "In comparison to the Soviets' offensive chemical-warfare capability, our posture almost invites the use of chemical weapons against us," notes Admiral James Watkins, U.S. chief of naval operations.

The Soviet Union has an estimated 100,000 people working on chemical warfare—a 12 to 1 advantage over the United States. The Soviets enjoy a numerical advantage of 5 to 1 in chemical delivery systems and 4 to 1 in chemical agents. The Soviets can initiate chemical attacks to all ranges, including very long ranges using tactical ballistic missiles armed with chemical warheads. The Soviets train extensively for chemical warfare, and they have shown their willingness to use these weapons in Afghanistan in violation of international agreements.

Defensive measures alone are not enough to deter chemical warfare. The clothing designed to protect U.S. troops

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JOHN W. WARNER is a two-term Republican senator from Virginia. He is a member of the Senate Armed Services Committee and chairman of its Subcommittee on Strategic and Theatre Nuclear Forces.

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leak, spill, or accidental release can devastate life downwind. This was tragically demonstrated in 1968, when the wind suddenly shifted during an open-air test of nerve gas at the Dugway Proving Grounds in Provo, Utah, killing 6,000 sheep grazing 30 miles away.

In response to that incident and the resulting public outcry, Congress blocked further "live" testing of nerve gas. A few years later, President Richard Nixon—with congressional support—decided to stop building new chemical weapons. Nixon also ordered older stocks of chemical munitions to be destroyed, and the stockpile's storage facilities to be moved from populated centers in Denver, Salt Lake City, and Baltimore.

Because of these changes, the Edgewood Arsenal in Maryland, the main production facility of the U.S. Chemical Warfare Service (now renamed the Chemical Corps), became something of a backwater in the 1970s. In an effort to postpone its own demise, the Chemical Corps introduced the concept of binary weapons. Its advocates have correctly argued that these weapons are safer to store and handle than the one-piece shells because the chemicals are benign until mixed. However, as opponents of binary weapons have noted, careful handling of existing armaments has prevented any further accidents.

Furthermore, binary weapons carry several serious disadvantages that seem to have escaped congressional notice. First, the 16-year ban on live testing has meant that binary weapons have never been field tested. The only other chemical weapon adopted without such testing was a complete failure. It turned out that the agent, developed by the British, could not withstand moisture.

Second, binaries are inefficient because they deliver much smaller amounts of active product per unit of volume than the one-piece munition. Internal separators, unreactive starting materials, and nontoxic byproducts of the reaction take up the extra space. In contrast, unitary shells contain only nerve gas. Thus, it takes a greater number of the new units to deliver the same wallop—at greater cost to U.S. taxpayers.

Third, binary weapons have far less tactical flexibility, since they can attack targets only at distances reachable during the time span of the chemical reaction. The chemicals in weapons used to attack more distant targets would burn up during the extra flight time. In addition, binaries are not useful in stationary munitions such as mines, or for low-flying aerial attack. During such an attack, the aerosol spray would be dispersed before the nerve gas was completely formed.

Losing the Advantage of Surprise

Using binaries also means forfeiting the main element of surprise in an attack. That's because when the chemicals react, they release either foul-smelling sulfur compounds or irritating hydrofluoric-acid gas, both of which can give the enemy enough warning to don protective gear or take an antidote. The enemy may also have enough time to launch a counterattack before being debilitated by the gas.

While the process of making binary shells may be safer, their actual use will be more dangerous because soldiers will have to rapidly assemble and load them during battle. That risk, of course, will be transferred to the places where they will actually be used. While military personnel wearing protective clothing might suffer few casualties, civilians would bear the brunt of the effects. A nerve-gas attack could also expose these same populations to nuclear attack, since a disabled enemy might be more inclined to launch a nuclear counteroffensive. It's easy to understand our allies' objections to these weapons, and hard to see why Congress has approved the development of munitions that cannot be stored at their intended sites.

Congress Intimidated

For all these reasons, binary weapons may actually be less effective and more dangerous than their unitary counterparts. Why then did Congress decide to fund their development? Pressure from the usual special interests is not a likely cause. Major chemical companies have been cautious about supporting binaries because of the fear of public outcry. In fact, until recently, even the army's top command did not aggressively support chemical warfare or the modernization of chemical munitions. The only certain beneficiary is the Army Chemical Corps., which launched the campaign.

Its crusade finally succeeded this year partly because of President Reagan's persistent lobbying efforts. The administration has effectively attacked any opposition to its foreign policies as being pro-communist. The result is an increasingly "McCarthyized" Congress whose members are afraid to dissent in defense matters.

The hostage crisis in Lebanon and the terrifying feeling of helplessness that swept this country last June made Congress even more receptive to the idea of chemical warfare. With Congress intimidated and U.S. foreign policy suffering a series of reversals, including the bombing of the Marine headquarters in Lebanon, the demand to increase American strength has become paramount. This fall, macho needs to restore America's image clearly obscured the judgment of Congress. □

The Boundary Dynamic

The Boundary Dynamic

The performance of a polymeric adhesive depends on the properties and composition of its surface. Now a scientist at the General Motors Research Laboratories has developed and validated a theory that describes the coupled effects of diffusion and chemical reaction on the changing surfaces not only of adhesives, but of chemically reacting surfactant systems in general.

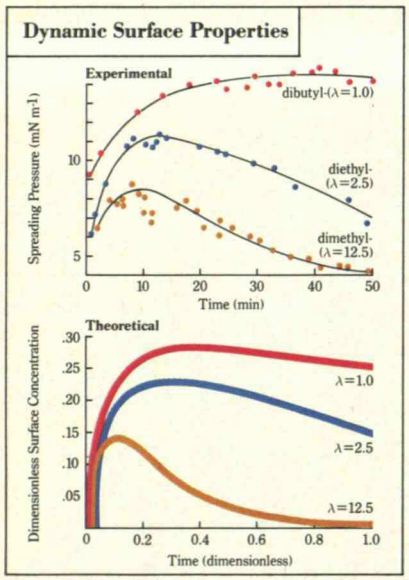


Figure 1: Experimental measurements of spreading pressure v. time for dialkylaminopropylamines with various Damköhler numbers (λ), and corresponding theoretical calculations of surface concentrations.

Figure 2: Evolution of an adhesive surface: Surface-active Solute 1 (red) reacts with host resin (pink tone) to form surface active Solute 2 (brown).

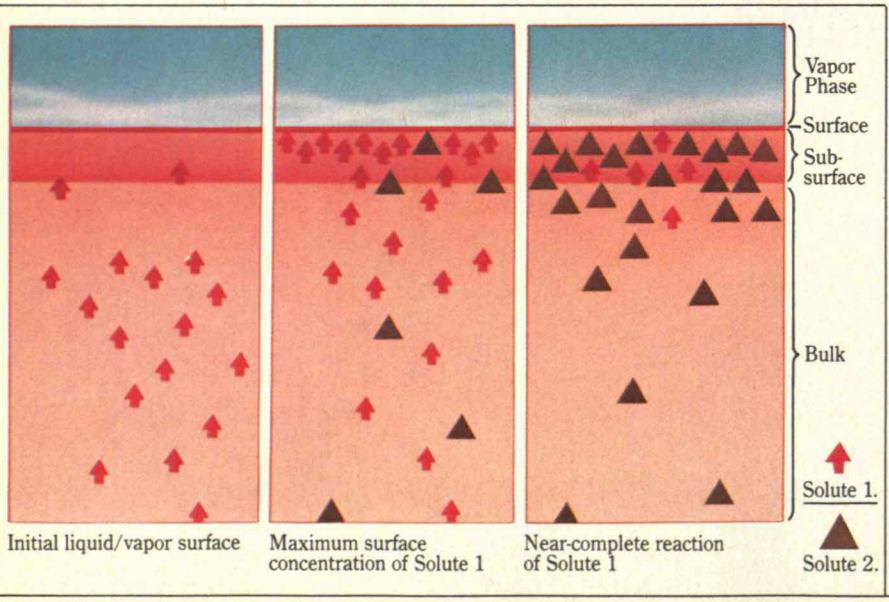
THE USE OF adhesives in the production of an automobile promises to make both the product and the process more efficient. Both weight and operations can be reduced. In practice, however, steel and other metallic surfaces are often contaminated by process lubricants. A durable bond depends on the ability of an adhesive to displace contaminants and to wet the substrate.

Assuring intimate contact between adhesive and substrate requires detailed knowledge of adhesive surface tension, since it is this property that controls displacement of contaminants and wetting. Up to now the surface tension of an adhesive has typically been assumed constant. In reality, though, surface-active components in the adhesive collect preferentially at the interface and also react, so that the surface composition varies with time, giving rise to dynamic surface tension. Variations can be large enough to significantly affect adhesive performance.

The understanding of time-dependent surface tension has been advanced by the work of Dr. Robert Foister, a scientist at the General Motors Research Laboratories. Investigation of dynamic surface properties of thermosetting adhesives led him to develop a general theory of adsorption kinetics in binary, chemically reacting surfactant systems. The significance of this theory is that it includes the coupled effects of surfactant diffusion and chemical reaction, making it possible for the first time to describe quantitatively the changing surfaces of such systems.

In a typical adhesive that polymerizes, or "cures," by chemical reaction (Figure 2), a surface-active curing agent (Solute 1) reacts with the host resin to form a second surface-active species (Solute 2) that is also reactive. Both solutes migrate to the surface, lowering the surface tension. Diffusion to the surface is driven by a potential energy gradient between the surface and the bulk, with the solute molecules experiencing a lower energy at the surface.

Dr. Foister derived appropriate transport equations to describe diffusion and chemical reaction in the bulk, in a subsurface region, and at the surface itself. The transport equations can be solved analytically if the chemical rate equations are assumed to be first order in the concentrations of reacting species, and if the subsurface and surface concentrations can be related to one another by a linear adsorption isotherm. For more complicated isotherms, a set of coupled, non-linear integral equations is generated.



These must be solved numerically.

Analytical solution for the special case of the linear isotherm indicated that the change with time in surface concentration (and consequently in surface tension) is composed of two terms: first the diffusive flux of Solute 1 into the subsurface from the bulk, and second the depletion of this solute due to chemical reaction. Hence, the surface concentration of Solute 1 exhibits a maximum with time (Figure 2). This maximum in surface concentration corresponds to a minimum in surface tension.

MODIFYING the transport equations to include binary adsorption isotherms allowed for consideration of competitive adsorption of the two reacting and diffusing solutes. By solving these equations numerically and conducting dimensional analysis, Dr. Foister identified various dimensionless parameters as predictors of system behavior. The most important of these parameters was a dimensionless number (λ), of the Damköhler type, involving terms representative of reaction, diffusion, and adsorption.

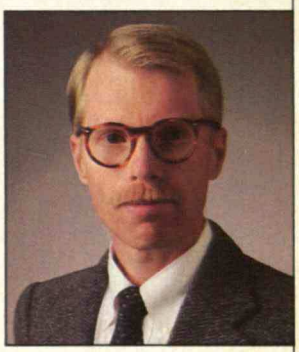
$$\lambda = \frac{k\,(\Gamma_m\, a)^2}{4D}$$

Here k is the reaction rate constant of Solute 1, D its diffusivity, Γ_m its "surface capacity" (the maximum number of molecules absorbed per unit surface area), and a its "surface affinity" (a measure of its energy of adsorption). For an adhesive, lowering λ by reducing k (the reactivity of the curing agent), for example, would prolong the time to maximum, and would increase the value of the surface concentration at the maximum (see Figure 1, Theoretical). As a practical consequence, this would improve wetting by minimizing the surface tension.

In experiments using a series of dialkylaminopropylamine curing agents (dimethyl-, diethyl-, and dibutyl-) in a host epoxy resin matrix, good agreement has been demonstrated between theoretical predictions for surface concentration and the measured dynamic spreading pressure, which is the change in adhesive system surface tension due to the curing agent (Figure 1, Experimental).

"I expect," says Dr. Foister, "that the physical insights gained from this analysis can be applied to other reactive surfactant systems by using specifically tailored isotherms and chemical reaction schemes. Predicting surface behavior can certainly help us design better adhesives for specific applications, but it is also pertinent to the performance of anti-oxidants and anti-ozonants in synthetic rubber, for example. And applied to interfaces in biological systems, a suitably modified theory may prove valuable in understanding the phenomenon of enzyme activity."

THE MAN BEHIND THE WORK

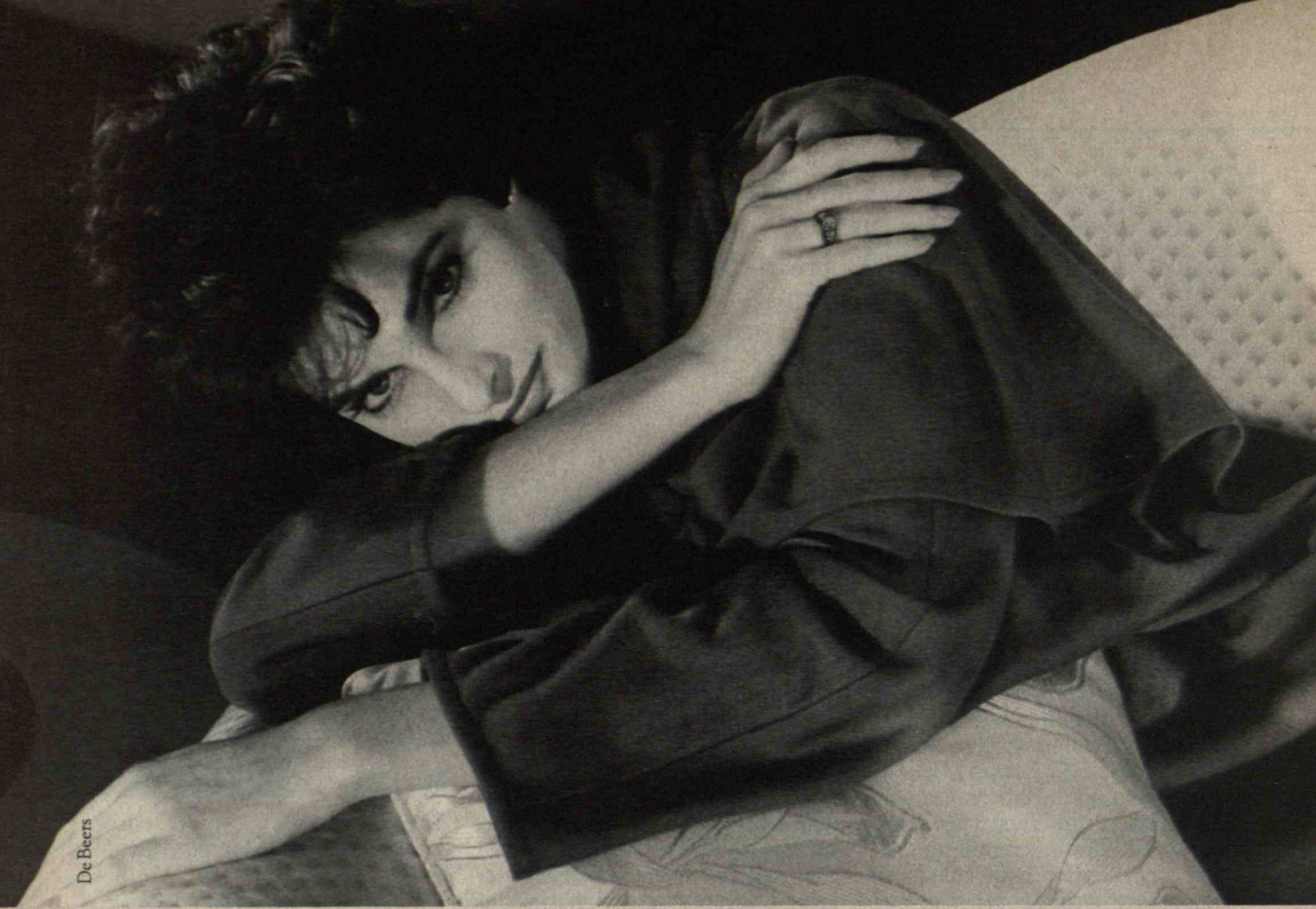


Dr. Foister is a Staff Research Scientist in the Polymers Department at the General Motors Research Laboratories.

Dr. Foister received his undergraduate degree from Guilford College, and holds a Ph.D. in Physical Chemistry from the University of North Carolina at Chapel Hill. His thesis dealt with the role of liquid inertia in the intrinsic viscosities of rod-like polymers.

He did post-doctoral work in Canada as a Fellow at McGill University in Montreal, and in the Applied Chemistry Division of the Pulp and Paper Research Institute of Canada, working on the microrheology of colloidal dispersions.

Dr. Foister joined General Motors in 1980. He is the leader of the Structural Adhesives Group in the GMR Polymers Department. His current research interests center on surface chemistry and adhesion.



GIVE HER A DIAMOND WITH A FIRE TO MAKE THE STARS BURN WITH ENVY.

Every quality diamond of a carat or more is one of nature's rarest and most exquisite phenomena. Each is a visible reflection of you. Unique in all the world, possessing four vital qualities that set it apart forever. They are called the 4C's: Cut, Color, Clarity and Carat-weight. It is the 4C characteristics that determine the value of a diamond—and to an astonishing degree the beauty and value of your jewelry—no matter what the design.

Your jeweler is the expert where diamonds are concerned. His knowledge can help make the acquisition of a quality diamond of a carat or more the beautiful, rewarding experience it should be.

Give her a quality diamond of a carat or more. A truly rare and beautiful gift. Like the woman you love.

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The ring shown features a quality diamond of 2.04 carats.

A QUALITY DIAMOND OF A CARAT OR MORE.
A FIRE RARELY SEEN.

CONTINUED FROM PAGE 19

from chemical attack is bulky and severely restricts the fighting ability of our aviators and ground forces. This impairment is likely to be decisive in battle.

Because of this problem, an attacking force using chemical weapons has a significant military advantage. In the face of a concerted Soviet attack that included chemical weapons, NATO's ability to defend itself would be severely undermined, and the allies would be forced to resort to early use of nuclear weapons. Thus, in the words of Gen. Charles Donnelly, commander-in-chief of the U.S. Air Force in Europe, our chemical posture "places dangerously inappropriate reliance on our nuclear forces."

Furthermore, our defensive equipment is designed to be effective only against known chemical agents. The Soviets have used some agents in Afghanistan that cause symptoms we do not recognize. We are not sure how effective our protective clothing would be against these agents.

Critics often raise two specific criticisms of the binary modernization program. First, they argue that since we are not allowed to conduct open-air tests of chemical weapons containing live agents, we cannot be sure that they will work. However, chemical munitions containing the actual agents are thoroughly tested in the laboratory. Munitions loaded with harmless simulants that have characteristics very similar to the chemical agents are then thoroughly tested in the open air. Together, these tests will give complete confidence that the new munitions will work as designed.

A second criticism of the program is that the United States should not modernize its chemical stockpile until our allies announce their willingness to store these weapons on their soil. The United States has not asked its allies to deploy the binary weapons, and it seems unlikely that they will agree to do so during peacetime.

The House of Representatives sought to make the consent of our allies a prerequisite to producing the new binary weapons. The Senate opposed such restrictions because, although basing the weapons in Europe is desirable, it is not essential for deterrence. Since they are safer than the old chemical weapons, binaries could be moved overseas quickly in the event of conflict. Also, as the use of chemical weapons in the Iran-Iraq War reminds us, Europe is not the only theatre in which U.S. forces could face a chemical threat.

The United States needs to produce binary munitions for the same reason that we produce M-1 tanks and F-15 fighter planes—to provide for the security and effectiveness of our forces worldwide. If we were to make the production of binary chemical munitions subject to the approval of our NATO allies, we would be giving them veto power over an important defense program.

Incentive for Chemical Disarmament

There is another important reason to support the chemical modernization program, and that is its relationship with U.S. arms-control objectives. The main U.S. goal in this field is to achieve a verifiable international ban on chemical weapons. This country has consistently taken a leading role in seeking chemical disarmament. Only last April, Vice-President George Bush proposed a draft treaty before the Committee on Disarmament in Geneva calling for a complete ban on chemical weapons. In view of the military advantage they currently enjoy, it is not surprising that the Soviets rejected that proposal.

The production of new chemical weapons is an emotional and politically unpopular issue. However, we must not forget the lessons of history regarding chemical warfare. In World War I, the Allies began making chemical weapons only after the Germans began chemical attacks against Allied troops on a massive scale. In World War II, Hitler refrained from using chemical weapons even in the final days of the Third Reich for fear that the Allies, who were also known to possess such weapons, would retaliate.

The U.S. unilateral moratorium on producing chemical weapons has continued for 16 years without any reciprocal restraint by the Soviets. Today, the Soviet Union has 14 active facilities for producing chemical weapons. If we are to minimize the chance that chemical weapons will be used against our troops and those of our allies, then we must give our forces an effective deterrent. Congress has at last recognized this responsibility, and its recent action to modernize our chemical arsenal will correct one of the most serious deficiencies in our defense posture. □

Saving the Rainforests, the Bell Breakup, and Fewer Medical Tests

Reversing Tropical Destruction

In the Rainforest
by Catherine Caufield
Alfred Knopf, $16.95

Reviewed by Norman Myers

Tropical forests constitute one of the richest stocks of natural resources on earth; they are also the least understood biome. Although our knowledge of rainforest ecosystems is increasing by leaps and bounds, we have identified only one in six of their millions of species. Yet tropical forests are being depleted faster than any other major ecological zone. Moreover, they are the least developed in the broad sense of the word—of employing management strategies to foster their sustainable use for all humanity.

In this "report from a strange, beautiful, imperiled world," Catherine Caufield presents a highly readable, personal account of travels throughout the tropical-forest realm. She got her boots muddy in forests from Central America to Southeast Asia, and this hands-on experience gives her descriptions the ring of the real world.

Yet one should not look here for the latest research findings on what makes the forests tick—or, for that matter, on how ecologists can keep them ticking. Caufield devotes only a small part of her book to describing the half of all species on earth that throng tropical forests. Instead, she concerns herself with the people who despoil them and seek to save them. She concentrates on migrant cultivators in Central America, pioneer entrepreneurs in the Philippines, transmigrant settlers in Indonesia, and displaced Indian tribes in Brazil. She also focuses on the enlightened foresters, land-use planners, and development technocrats who appreciate the urgent need to better manage this extraordinarily rich resource.

Caufield particularly stresses the institutional and economic quirks that foster destruction of rainforests. She describes how, in parts of Latin America, a tract of forest that is left undisturbed is deemed by law "unimproved" and therefore taxed more heavily. Land-tenure systems that favor large-scale farmers to the detriment of small landowners also promote a migration into the forests. And Caufield plainly feels for the landless farmers who see no alternative but to chop down the forest, thereby undercutting the source of their livelihood. These small farmers traditionally allowed cleared patches to remain fallow for a couple of decades so that nutrient stocks could regenerate. Yet today the number of landless squatters has grown to such an extent that they advance upon the forest fringe without allowing for regeneration.

Despite her concern, Caufield somewhat understates these problems. While claiming that 30 acres of forest are destroyed every minute (a more accurate figure is at least 50 acres), she does not mention that at least as much again is grossly disrupted and impoverished. We who do not live in countries with rainforests have a right to be concerned with this destruction, as Caufield says, not only "because millions of our fellow creatures—humans, animals and plants—depend directly upon the health of the rainforests," but also because "hundreds of millions more, including those in the industrialized countries, rely upon them indirectly, and because so much rainforest is destroyed in our names and with our money."

In medicine alone, we in the north use many drugs and pharmaceuticals—antibiotics, tranquilizers, emetics, diuretics, and the like—that owe their manufacture to materials from tropical-forest plants. The contraceptive pill originally derives from a yam of Mexico's forests. The rosy periwinkle, a native of Madagascar's forests, has yielded two potent drugs for use against blood cancers. According to the National Cancer Institute, tropical forests might harbor another 10 plants with the capacity to generate "superstar" drugs against cancer. So by saving the lives of tropical-forest plants, we may be saving our own.

New Plan to the Rescue

While generally strong on describing problems in the rainforest, Caufield's book is short on answers. This lack of constructive responses is especially regrettable because some tropical-forest countries—including Venezuela, Costa Rica, and even Brazil—are making some remarkable, if long overdue, efforts to redress the situation. Whereas many leaders used to perceive tropical forests as "resources going to waste," even as "obstacles to progress," some now regard rainforests as sources of critical environmental services—watersheds that safeguard soil cover, mitigate river flows, and limit sedimentation. A growing number of countries want to review the entire situation and explore ways to protect their forests, and even to replace those that have been eliminated. At the same time, some developed countries are recognizing that they have a stake in preserving the contributions of the rainforests to global climatic patterns.

Thus, the World Bank and the World Resources Institute have devised a comprehensive, systematic plan to work with other development banks and aid agencies to stem the threat to global rainforests. The plan calls for greatly increasing the number of tree farms that supply commercial timber, thereby relieving pressures to exploit the remaining undisturbed forests; increasing fuelwood plantations tenfold; rehabilitating 1.6 million square kilometers of watersheds and catchment zones; safeguarding the millions of species at risk; markedly expanding research, training, and education programs to increase knowledge of rainforests; and upgrading subsistence agriculture. The plan would cost about $1 billion a year to implement, and developing countries are showing a willingness to pick up a sizable part of the tab.

Of course, such a plan will not get off the ground unless it is accepted by political leaders, who will base their decisions on public opinion. And public opinion needs all the stimulus it can get. Fortunate it is

ILLUSTRATIONS: EUGENE YELCHIN

that Caufield's book has arrived on the scene at such an opportune time, since it does a rare job of describing the problem for a broad audience. □

NORMAN MYERS, a consultant on environment and development, is the author of The Primary Source *(W. W. Norton, 1984), a book about tropical forests.*

Breaking Up Bell

Disconnecting Parties
by W. Brooke Tunstall

Reviewed by Edward E. David, Jr.

In *Disconnecting Parties,* Brooke Tunstall, vice-president of AT&T during its recent monumental metamorphosis, gives an important account of the churning necessary to achieve the breakup of the Bell system. Tunstall is uniquely qualified to write such an account given his service in many parts of the system, including Bell Laboratories. He sees forced divestment as the product of willful men with doctrinal hangups, including Judge Harold Greene, who presided over the antitrust suit; Assistant Attorney General William Baxter, who argued the case for the Justice Department; and Rep. Timothy Wirth (D-Colo.), who threatened legislative action to restructure the industry. Tunstall also implicates the potential and actual competitors of the Bell system, who coveted a piece of the telecommunications action and became parties in the case.

However, the author doesn't venture to estimate the cost to the public of all this unproductive activity. Clearly it has been and will be high. According to Judge Lee Loevinger, formerly a member of the Federal Communications Commission (FCC), the public has "benefited" from "worse service at a higher price." *USA Today* has cited "persistent confusion and frustration . . . declines in service quality . . . and local rates that have spiraled up 33 percent since 1981."

The purported goal of the breakup—increased competition—seems also to be elusive, since the FCC is in the process of allocating the long-distance market among various providers. Although consumers can choose any long-distance carrier, FCC guidelines provide for assigning a carrier to those who fail to specify a preference, as most will.

Tunstall's account provides insight into one of the most courageous management decisions of our time: that of AT&T Chairman Charles Brown to cut the Gordian knot fashioned by the courts, lawyers, legislators, and regulators rather than to continue to fight the Justice Department suit. Only someone confident of his organization's abilities could have decided to render asunder the unitary telecommunications network woven over decades. That wholism was designed to assure the efficient and universal services specified by the Communications Act of 1934. The difficulties of integrating any technological system are legendary, but Tunstall shows that fragmenting such a system may be even harder, and in this case impossible. Easy communication requires compatible connections, which are difficult to set up among different firms.

Tunstall describes how AT&T's new competitive stance dictated that it set up autonomous operations for each "line of business." The most vexing question was whether to develop products and engineer systems within each line. Doing so would have meant dismantling Bell Labs, the source of so many technological innovations and advances in basic science, such as the transistor and optical fibers. AT&T couldn't justify such a drastic solution, and in the end chose to keep Bell Labs intact but to couple its R&D closely to business purposes. Thus, its ultimate fate remains uncertain.

However, a new R&D venture has emerged from the divestment. The regional Bell companies, which quickly became competitive and even antagonistic, recognized their common needs enough to establish Bell Communications Research as a joint R&D effort. "Bellcore" draws many of its scientists from Bell Labs. This scheme resembles the efforts of competitive companies in Japan to pool their resources, and could be a blueprint for other such efforts by U.S. industry if the Justice Department finds that it does not violate antitrust laws.

Divestment was a massive managerial feat, and Tunstall draws important lessons—such as how to balance day-to-day tasks with long-term policy changes—for managers who face unaccustomed tasks. He also contrasts regulated and competitive industries, finding that technologies rather than markets drive regulated firms, and that the opposite is true for competing firms.

Perhaps someday we will know the ultimate results of the Bell system breakup. So far, this attempt by government to set statesmanlike telecommunications policy has failed. The public was not consulted or even largely aware of the proceedings, yet it is on the public where the impact will fall. If there is hope, it stems from the attitude of former Bell employees, who now look to the future with the same positive outlook and ingenuity as before. Chairman Brown's effort to maintain this attitude even in the face of upheaval may prove the most valuable legacy of the Bell system. □

EDWARD E. DAVID, JR., president of Exxon Research and Engineering Co., was formerly executive director of Bell Labs and science advisor to President Nixon.

Questioning the Need for Medical Tests

Matters of Life and Death
by Eugene D. Robin
W.H. Freeman, $21.95

Reviewed by Deborah A. Stone

Critics of the medical establishment often argue that wider use of mass screening and early diagnosis is the only effective way to reduce mortality and illness. Moreover,

detecting diseases in their early stages makes economic sense, they maintain, because it is cheaper than curing fully developed illnesses.

In this context, Eugene D. Robin's *Matters of Life and Death: Risks vs. Benefits of Medical Care* is heretical. Robin's central message is that many—if not most—of the standard diagnostic and therapeutic procedures in use today have not been adequately tested for their actual risks and benefits, and that they are often performed with little regard to their impact on the individual's well-being. Robin takes on most of the sacred cows of modern medical practice—annual checkups, routine blood counts and urinalyses, pap smears, blood-pressure measurements, cancer screening, breast self-examination and mammography, stool guiac tests for colon cancer, many biopsies, and tonometry screening for glaucoma.

Diagnostic tests are problematic in several ways. They always yield "false negatives" (people found to be free of a disease but who actually have it) and "false positives" (people indentified as having the disease but who really do not). Many of the tests also entail risks, and the more invasive studies and treatments they occasion carry even greater risks. Many of these further tests serve only to classify a patient's symptoms as a particular disease for which there is no standard or effective treatment.

Pap smears—the routine exams for cervical and uterine cancer—provide a

Rarely do medical educators warn of the pernicious effects of tests on "false positives."

good example of some of these problems. Major health-education campaigns have promoted the use of pap smears since the 1950s, and by 1976 about 60 percent of U.S. women reported having had one the previous year. According to Robin, these tests took hold in public-health dogma without controlled studies on their effects. However, the rate of false positives from pap smears is very high. (Unfortunately, Robin doesn't cite any figures on how high.) That is because interpreting the microscopic slides is difficult, because many common vaginal infections can produce cellular changes like those of cancer, and because many women with cancer cells never develop the invasive cervical cancer that needs treatment.

Robin holds that any weighing of the effectiveness of the Pap smear must take into account the size and experience of the false positive group. Women with positive Pap tests must endure intense anxiety and the pain and expense of further tests, including cervical biopsies. If the biopsies are also positive, many women undergo complete hysterectomy. Women with positive smears not found to have cancer cells are followed as "cancer suspects" for the rest of their lives.

Problems with Peer Review

As Robin points out, medical experts often pursue the quest for diagnostic information even when it will not change their treatment of particular patients. Many brain biopsies fall in this category. This mindset results in a preoccupation with disease in normal people, and helps create a "more technology is better" attitude that drives the medical system.

Robin identifies a host of factors that account for medicine's unrestrained embrace of information and technology. He points out what health-care analysts have long maintained: that doctors get paid for doing tests, writing prescriptions, and performing operations. They do not get paid for waiting to see how a person's symptoms develop.

Robin also cites a major problem as the view, central to much medical training, that undiagnosed and untreated disease is the most dangerous enemy. Rarely do medical educators warn of the pernicious effects of diagnostic tests on false positives and the considerable risks of hospitalization. Many doctors regard a "definite diagnosis" as an end in itself and brand others who refuse to pursue it as "diagnostic nihilists." Physicians justify this pursuit of knowledge for its own sake as essential to medical progress. Of course, extensive testing also protects doctors from malpractice suits, and helps them decide whether to perform risky treatments.

Another spur to overtesting is the current system of peer review of medical research and clinical practice. In-hospital "mortality and morbidity conferences" typically scrutinize patient cases for actions that doctors have omitted, increasing the pressure to overtest and overtreat. A

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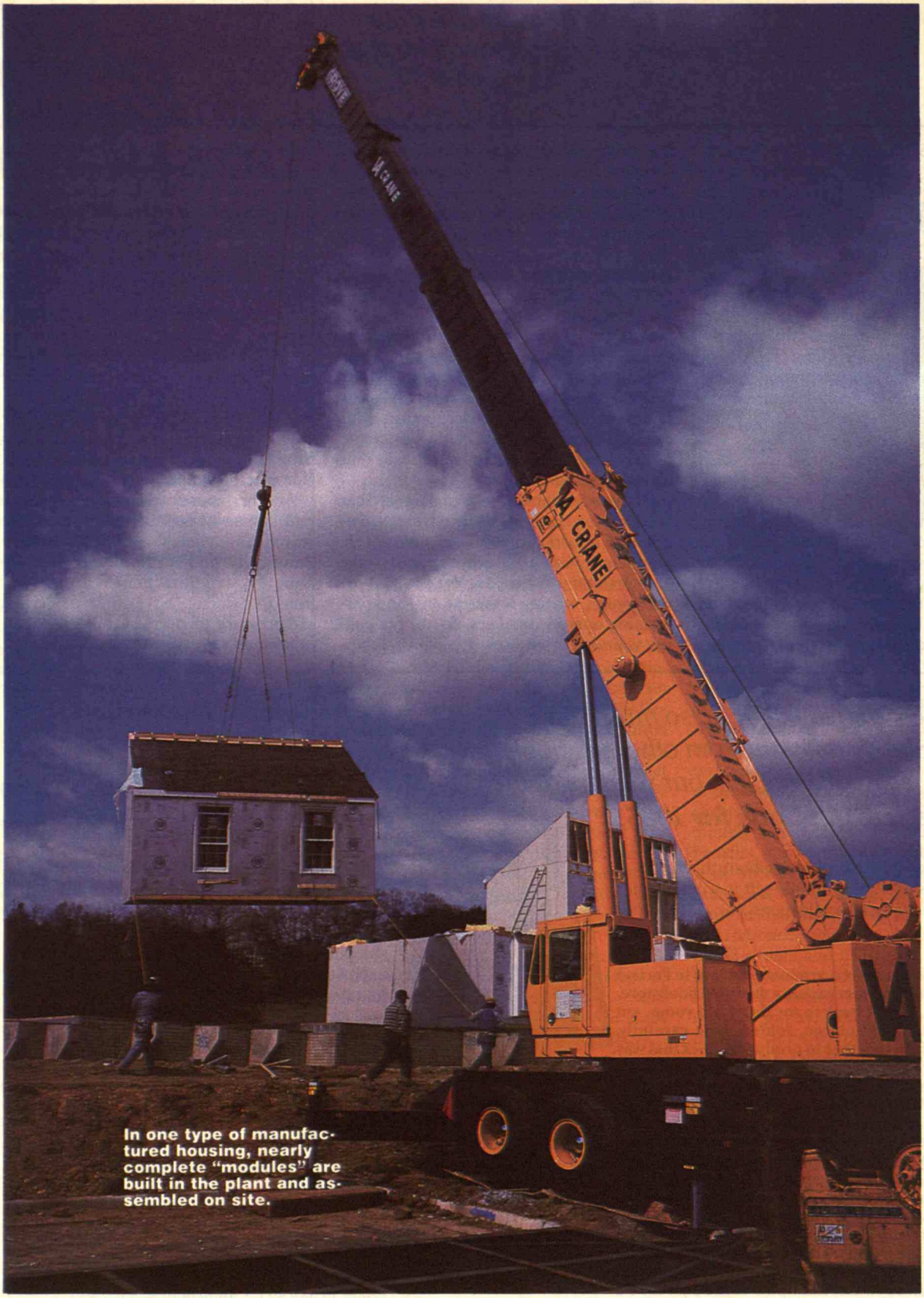


In one type of manufactured housing, nearly complete "modules" are built in the plant and assembled on site.

The House That Machines Built

HOUSING costs have increased dramatically over the past decade, and mortgage interest rates seem firmly fixed in double digits. Where once more than three-quarters of U.S. families could afford to buy a new home, now only one-quarter can achieve that classic American dream. A logical way to reduce costs without sacrificing quality is by manufacturing homes, or large components of homes, in factories instead of building them from scratch on the site.

The manufactured housing industry has grown appreciably in recent years. In 1984 almost half of all new housing units were at least partially manufactured. House manufacturing is similar to on-site construction but can be superior because it is done indoors under controlled conditions. It reduces construction costs through economies of scale and efficiencies of the assembly line.

However, technology is only one of the advantages manufacturers have over other builders. The benefits of more efficient organization, better financial backing, and corporate marketing techniques can be at least as important. And if manufacturers work for more consistent and rational building codes and development regulations, the costs of this type of housing could be reduced even further.

A manufactured house is built, to a greater or lesser extent, at a location other than where it is ultimately sited. The catch in that definition is the phrase "to a greater or lesser extent." Manufactured houses come in three types, depending upon the extent of off-site construction:

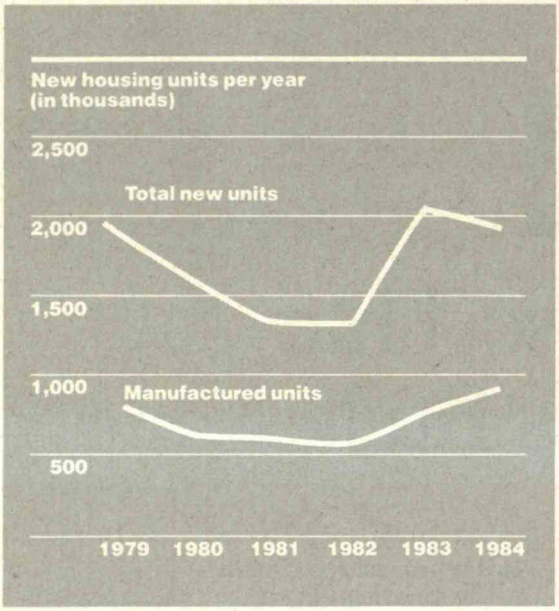
☐ *Modular* houses are built largely at a factory and moved to the residential site with three or four walls, the floor, and the ceiling in place. Many also come complete with a roof. All structural components, most mechanical and electrical systems, most finish aspects such as baseboard and wallpaper, and often furnishings (drapes, carpeting, stove, refrigerator, and so on) are installed before the houses leave the factory. Mobile homes, one type of modular housing, also incorporate a frame and wheels so they can be towed along the highway. Once installed at the site, however, "mobile" homes are rarely moved again.

☐ *Panelized* houses arrive at the site as preconstructed wall, floor, and ceiling components that workers erect and join together. These panels may be either "open" or "closed." In open panels, all

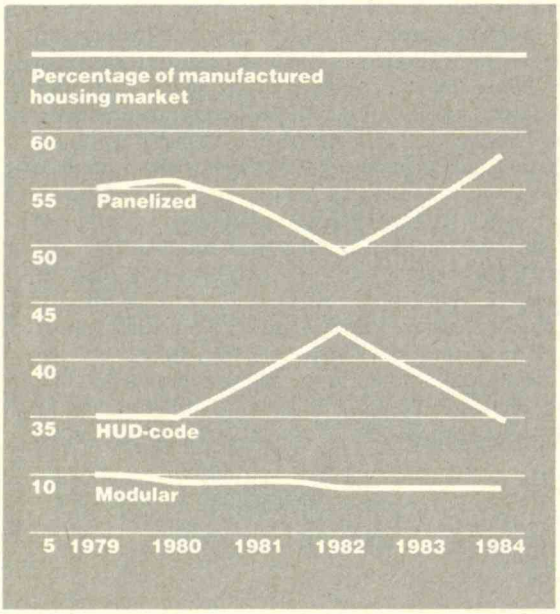
BY THOMAS E. NUTT-POWELL

House manufacturing reduces costs. Further gains require improved management and more rational building regulations.

PHOTO: HOME MANUFACTURERS COUNSELS OF THE NATIONAL ASSOCIATION OF HOME BUILDERS



Manufactured homes account for some 40 to 50 percent of all new housing.



DIAGRAMS: OMNIGRAPHICS

Though panelized housing has prefabricated wall, floor, and ceiling components, it requires substantial work on site. Like other housing construction, panelized construction declined during the early eighties. The federal HUD-code regulates housing constructed of "mobile" units. Several units, built in a plant and assembled on site, make a house much like any other, but less expensive. Customers turned to such housing during the recession.

electrical and plumbing work is completed on site, as is most exterior and interior finishing. In closed panels, electrical and plumbing work is done at the plant and enclosed within the panels. Interior and exterior finishes are also largely completed.

□ *Precut* houses arrive at the site with all the necessary pieces provided and marked to indicate the manner of assembly. Few components, with exceptions such as stairs and windows, have been assembled at the plant. The manufacturer may provide finish materials and furnishings.

From 1979 to 1984, manufactured houses accounted for over 40 percent of all housing starts, with the figure hitting nearly 50 percent in 1984. Between 1979 and 1984, 54 percent of all manufactured housing units were panelized or precut, 37 percent were modular in the mobile-home tradition, and 9 percent were other types of modular.

Manufactured houses, no matter how they are built, come in all shapes and sizes—including ranch houses, colonials, contemporaries, capes, gambrels, chalets, mobile homes, and beach houses. Nor is manufactured housing limited to single-family detached units. Manufacturers routinely construct multifamily units up to five stories tall, as well as townhouses, duplexes, quadraplexes, and other attached forms of housing. The fact that manufactured houses can be made to look just like the full range of site-built houses means that homeowners don't have to sacrifice personal tastes.

This is critical for the future of the industry because most people associate manufactured housing with mobile homes. And when they say mobile homes, they mean pink-and-white house trailers, out by the aquamarine dinosaur at the miniature golf course at the edge of town. In fact, contemporary mobile homes are well-built and in good taste, and they are far from the only type of manufactured housing.

Building from the Inside Out

The volatility of housing demand, which is sensitive to economic cycles and differs among local areas, makes centralized production and dominance by a few producers impractical. About 600 companies now manufacture houses in the United States. A U.S. plant's capacity can be as many as 1,400 units annually, but market share and transportation costs usually set lower limits on how many units are actually produced. Firms that manufacture housing for luxury markets can survive by making fewer than 100 units annually. Manufacturers producing mobile

American firms should not blindly emulate the Japanese level of automation.

homes for lower-income markets may need to make 600 or more units per plant each year. The large producers scatter plants and subsidiaries throughout the nation, each serving particular markets. For example, Fleetwood Enterprises, which produced 39,579 houses in 1984, had 25 plants in 11 states from Florida to California.

In most factories, the manufacturing process resembles wood-frame construction brought indoors. Compared with many other industries, manufactured housing makes only minimal use of technological advances. Its assembly lines are not highly mechanized, nor do they produce high volumes. Housing manufacturers do use new tools (such as pneumatic nailing guns), new materials (such as PVC pipe), and new methods (such as special jigs for cutting and fitting wall framing). However, the activities at a typical housing plant would not be unfamiliar to anyone who has observed an ordinary construction site.

The assembly line for modular houses illustrates how the manufacturing process works. In contrast to on-site construction—where houses are built "outside in"—modular houses are more efficiently built from the inside out. Factory workers first construct the floor. To it they add electrical, plumbing, and heating components assembled elsewhere in the plant. The availability of new materials such as PVC pipe and insulated, lightweight heating ducts makes this process relatively easy. A worker carrying a 50-foot-tall plumbing tree to the assembly line is one of the more interesting sights in a manufactured-housing plant. Walls are also built off-line and added to the module as it moves from station to station.

Exterior walls, with electrical components already installed, are then added to the home and exterior finish applied. If the home is a single-story, single-family detached, the roof may well be added at the next-to-last station. Finally, the electrical and plumbing systems are tested. Plants making panelized and precut housing use similar procedures, but the final structures are not assembled in the factory.

Manufactured-housing structures cost 5 to 40 percent less than the same structures built completely on site. (This comparison excludes nonstructural costs such as those for purchasing the land, preparing the site, and securing financing.) Some of the primary gains from factory construction stem less from the machinery than from the managerial efficiencies that also typify mass production. Turning the building of houses into a manufacturing endeavor smoothes seasonal construction cycles somewhat, allows economies in buying materials, and helps companies predict construction costs and schedules. Moving the building process inside also improves the precision and quality of construction and eliminates the impact of environmental effects, primarily bad weather.

The use of standard components, dimensions, and assembly procedures allows a housing company to hire semi-skilled rather than trade labor, thus reducing costs. Semi-skilled workers perform well-defined tasks at a given work station. And unlike traditional construction workers, all those in house-manufacturing plants start at the same hourly wage, winning raises according to seniority, not task. Workers thus gravitate toward the jobs that they find most appealing—not those with the highest financial rewards—and are likely to work at tasks keyed to their skills. Most manufactured-housing plants are not unionized. If unionized, they are organized by industrial rather than trade unions.

Lessons from Japan?

In the quest to improve the fortunes of U.S. home manufacturers—and in admiration for automated production—some industry observers have looked to Japan for guidance. Their perception is that, as with cars and other consumer products, the Japanese have made the most of applying technology to building homes. However, Japan's housing needs differ greatly from those of the United States. A large proportion of Japan's population lives within a 300-mile-long corridor linking Osaka, Kyoto, and Tokyo. Houses are usually small and keyed to dimensions that are multiples of the traditional *tatami* floor mat.

Japanese house manufacturers primarily serve the luxury market. There are relatively few producers—the top five firms make 75 percent of the country's manufactured housing. And with over half of the potential market within a fairly small area, firms can build all the homes they need in one plant. Most plants build 500 to 1,000 units per month.

Japanese manufactured houses continue the country's traditional post-and-beam design, with steel replacing wood for posts, beams, and wall framing. The main production activity in a factory involves shaping steel parts and assembling them into components and modules. This process entails a substantial amount of work: a typical 1,500-square-foot manufactured home—large compared with other Japanese homes—might have 10 to 15 modules, each composed of steel frame and flooring.

Japanese manufacturers also produce the panels used to complete the interior and exterior of the

A national building code could greatly reduce housing costs.

home. Most panels are wood, some sandwiching an insulating material between outer surfaces. One manufacturer has devised a new precast, lightweight concrete wall system that is fire resistant and strong enough to withstand seismic shocks—two major concerns in Japanese housing. The same firms or their subcontractors also manufacture many of the functional components of houses, such as "unitized" bathrooms complete with walls, floors, ceilings, fixtures, plumbing, and electrical wiring.

Japanese producers use many parts: one manufacturer lists an inventory of 500,000, ranging from bolts to bathrooms, to build its various models. In large-volume factories assembling so many parts, a high level of automation and extensive use of computers for design, manufacturing, and management are practical.

However, even for manufacturers that produce nearly complete modules, workers still do a substantial amount of work on site. They complete almost all the interior and exterior finishing and, except in the case of unitized bathrooms and kitchens, plumbing and electrical work. While it takes less than a day to assemble the components in the plant, it takes nearly two months to complete site construction.

Compared with Japanese firms, with their computer-controlled production lines, U.S. companies are decidedly low-tech, or even no-tech. Some companies do use computers in design, accounting, and management. But overall, U.S. housing manufacturing has seen little automation. For example, in most plants workers actually push houses from station to station. Even so, it would be a mistake for U.S. firms to blindly emulate the Japanese or their level of automation.

The fact that Japanese firms rely on high volumes to support major capital investment, use steel as a major building component, and leave plumbing, wiring, and finishes largely incomplete makes it impractical to transfer their methods directly to the United States. U.S. housing markets are too disparate—both geographically and in terms of consumer preference—for the volumes needed to support highly automated plants. The large amounts of steel would be prohibitively expensive and structurally excessive. And the substantial work required at the Japanese site adds cost and complexity to a product that should be less expensive and less complicated than other types of homes.

Even within factories, Japanese manufacturers do not apply automation uniformly. Not all plants have automated paneling construction, not all have automated steel-frame welding, and so on. Managers mechanize a plant only to solve particular production problems. When the demand for homes exceeds the capacity of the staff, firms introduce high-tech production techniques. Companies try to maintain a balance between their commitments to their staff and their production requirements. It is this careful effort of Japanese manufacturers to determine the most efficient combination of labor, machinery, and management that can best be applied to the U.S. experience. With technology, "can" should not mean "ought."

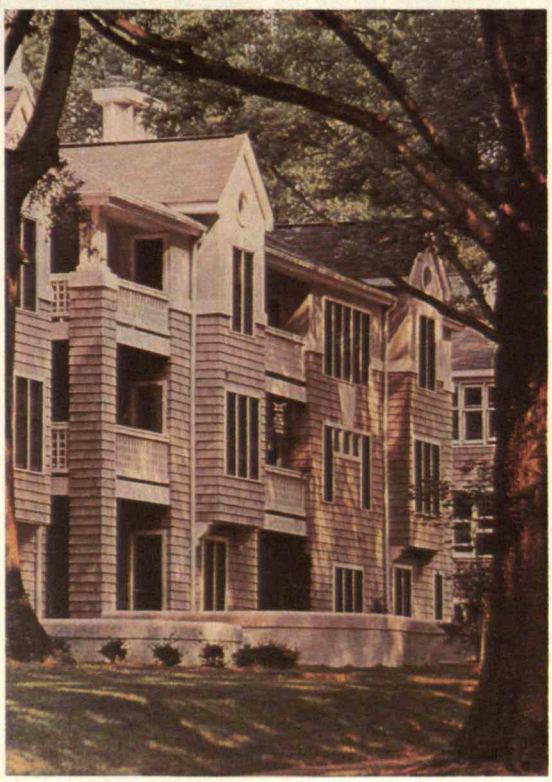
The Japanese have also shown the value of vertical integration in housing. The same company handles production, on-site installation, finishing of the interior and exterior, marketing, financing, and even care of the home after its owners have moved in. This enables the firm to develop name recognition of its product among consumers, making marketing easier. Vertical integration also makes more capital available for developing new products: Japanese firms spend 2 to 5 percent of their gross annual revenues on R&D, both technical and marketing. U.S. firms spend almost nothing.

The Magic Isn't in the Machines

Although manufactured housing *structures* cost much less than comparable site-built structures, that difference is not often reflected in final sale prices. The structure typically accounts for only about 50 percent of the sales price. This price also covers the cost of buying the land, preparing the site (laying foundations, making utility connections, doing landscaping), developing the parcel (providing an access road and water and sewer lines), securing public permits, and paying construction-loan interest, insurance, and broker fees. In addition, the developer must make a profit. Thus, a 10 percent decrease in the cost of a structure would cut a home's total cost by only 5 percent. As a result, while the technology of U.S. housing manufacturing could be improved, greater gains are possible in other areas.

The manufactured-housing industry has pioneered two improvements in building codes that could prove important. First, manufactured housing is generally governed by a different type of code than site-built housing. Site-built codes are called "input codes" because they require builders to take specific steps—for example, to use floor joists of certain dimensions and to space wall studs a certain distance apart. Codes governing manufactured houses tend to be "performance-based." Houses must be able to meet perfor-

Manufactured housing is well-built and often indistinguishable from standard housing built on-site.



These two photos show examples of panelized housing in Gastonia (top) and Charlotte, N.C.

PHOTOS: MICHAEL KONDRA

mance standards in areas such as energy efficiency and structural durability. For example, the houses must have the strength to support a certain roof load from snow and to stand up to winds of a certain speed. Performance codes are an improvement over input codes because they ensure quality while allowing for more variation and innovation.

Second, some manufactured housing—the type that has come out of the mobile-home tradition—is now built to a single federal code rather than a patchwork of local ones. Before the mid-seventies, state regulation of mobile homes was spotty and construction was sometimes poor. Manufacturers pressed for uniform national standards, and the federal government was legally able to promulgate national codes since these homes are transported across state lines. In 1976 the U.S. Department of Housing and Urban Development (HUD) issued the so-called HUD-code, which preempts all local codes and requires that this type of housing conform to federal construction and safety standards. Other types of manufactured housing are still governed by the codes of the state or

PHOTO: MANUFACTURED HOUSING INSTITUTE

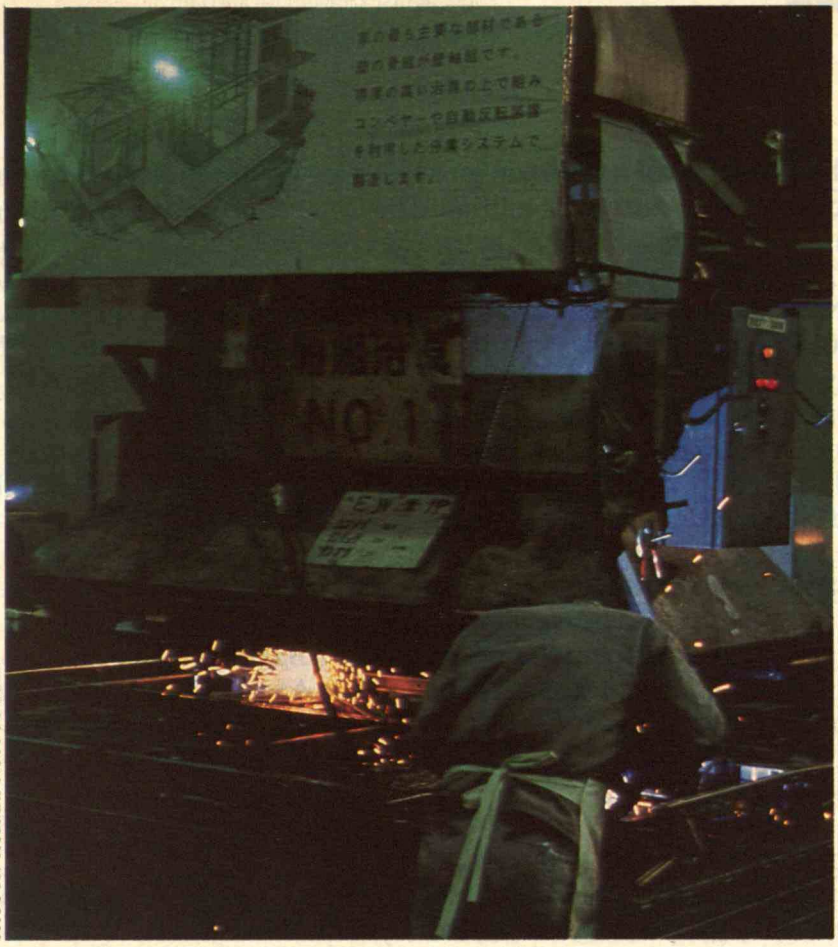
PHOTO: CARDINAL INDUSTRIES

Top: Modules—complete units of floor, walls, and roof—on the assembly line. Below: Manufacturers rely on much the same tools as site builders but save costs through the managerial techniques of mass production.

municipality in which the structure will be located.

Experience with the HUD-code shows that costs can be substantially reduced if builders must satisfy only one national performance-based standard. HUD-code housing is less expensive than any other form of housing, site-built or manufactured, yet quality is not compromised. And the HUD-code does not preclude regional variations; it sets different roof requirements for zones with varying snow and wind conditions, for example. However, developing national performance-based codes for all types of housing will not be easy, given the tradition of home rule in many states and communities.

Setting up more rational regulations for nonstructural factors such as lot size, road and utility construction, and public fees could also reduce costs dramatically. For example, over the last few years HUD has sponsored a project called the Joint Venture for Affordable Housing, in which developers have built demonstration housing in various parts of the country, some using manufacturing methods. Builders for this project have worked under a more practical set of nonstructural regulations than those in force in most localities. One example is road width.



PHOTOS: THOMAS NUTT-POWELL

Because Japanese home manufacturers rely on high volumes and produce steel structures, their plants are often highly automated. Left: An automated frame welder. Below: A lightweight concrete wall panel. Such automation is impractical in U.S. plants, which produce a relatively low volume of wood homes for disparate markets.

It is not uncommon to be driving along a small town road and see a turnoff to a far larger development road. Some codes specify a small access road for fewer than 10 houses and a larger one for over 10—but that means the developer must build the same size road for 11 houses or 50. Improving such nonstructural regulations saved 10 to 15 percent on the HUD Joint Venture projects.

While different levels of government need to establish more sensible housing regulations, manufacturers could improve their marketing, finance, and management strategies, somewhat along the lines of the integrated Japanese firms. Cardinal Industries, which serves the Midwest and Southeast United States, has adopted one possible strategy in this area. It offers only single-story homes and apartments that can be created by joining together standard 12-by-24-foot modules; customers have some choice in finish materials. Not everyone would be willing to accept such limitations. However, customers who are can obtain less expensive housing, because the company can achieve economies of scale in buying materials and can avoid making changes in the assembly line. Ryan Homes, based in Pittsburgh, is trying another approach to reducing costs. The firm has made a major R&D commitment to determining the most efficient ways to assemble its panelized houses on site. Other manufacturers, such as Benchmark Homes of Dayton, Ohio, have used their housing plants to make units for their own development projects, thus eliminating the need to sell individual structures.

Housing manufacturers can use technology along with improved management to streamline their operations and reduce costs. Computers are probably more useful for improving overall operations than they are for nailing a 2-by-4 on the assembly line. It is only through concerted efforts to make all aspects of the industry more efficient that the United States will be able to produce more affordable housing.

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SCIENCE/SCOPE®

The U.S. Department of Defense has given two of its four top money-saving awards to Hughes Aircraft Company for proposals that will cut costs by nearly $275 million. The Contractor Value Engineering Achievement Awards honor defense contractors for helping to trim defense costs during 1984. The Air Force cited Hughes for saving $172.8 million on the Imaging Infrared Maverick air-to-surface missile over the life of the contract. The Navy honored the company for reducing projected costs on the UYQ-21 data display system by $101.5 million. Hughes also contributed to the savings achieved by FMC Corporation, which won the Army award for cost-cutting efforts on the Bradley Fighting Vehicle System. The Value Engineering program was created to cut production costs without affecting performance, reliability, quality, maintainability, and safety standards. Last year the armed forces approved 34 Hughes VE proposals for total cost reduction exceeding $296 million. Since 1964, Hughes military customers have approved 705 changes on 52 programs for total savings of $887 million.

International business communications are entering a new era with the advent of direct satellite links. Hughes Communications Carrier Services, a Hughes subsidiary, has been authorized by the Federal Communications Commission to provide International Business Services (IBS) directly through INTELSAT satellites. Ground stations will be established in Brooklyn, Los Angeles, Chicago, and San Francisco to provide service to Europe, Canada, Latin America, and the Far East. Networks will be designed to meet specific corporate requirements, including voice, data, telex facsimile, electronic mail, and video conference services.

A streamlined antenna introduced on a new Mexican communications satellite promises to cut the weight and complexity of future spacecraft. The antenna eliminates potential deployment, structural, and alignment problems associated with multiple-reflector antenna systems on small communications satellites. Morelos, a Hughes HS 376 satellite, has a planar array that acts as a single reflector system operating in both the C- and K-band frequencies. The planar array is a simple beam configuration that has been used for decades on radar systems. On Morelos, the array measures 1½x3 feet and 1 inch thick. It replaces a reflector that would have been about 3x6 feet in size.

For the first time, parts of northern Brazil are receiving telecommunications, thanks to the new Brazilsat communications satellite. The spacecraft brings expanded telephone, television, telex, and data transmission services to all of Brazil. The HS 376 series satellite was built under license from Hughes by Spar Aerospace Ltd. of Canada for EMBRATEL, Brazil's state-owned telecommunications company. As a major subcontractor, Hughes supplied electronic components, mechanisms, and subsystems for the satellite. Brazilsat, launched from an Ariane rocket, is the first HS 376 to operate below the equator, and is therefore inverted or oriented "upside down" in space.

Hughes is seeking experienced engineers and scientists to further develop advanced spacecraft systems and components for communications satellites—successors to the 20 that will have been launched from the space shuttle by 1986. Openings are in the fields of: software, computers, and data processing systems; electrical components; microwave/RF communication systems development; on-board spacecraft electronics and control systems; satellite design, integration, propulsion, and electrical power system development; spacecraft manufacturing, systems test and evaluation; GaAs applications R&D. Send your resume to Dan Frownfelter, Hughes Space & Communications Group, Dept. S2, S4/A300, P.O. Box 92919, Los Angeles, CA 90009. Equal opportunity employer. U.S. citizenship required.

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CONTINUED FROM PAGE 29

more recent innovation in peer review—the consensus conference—brings experts together to make policy recommendations for using a procedure or technology. These conferences are typically staffed by people who have helped develop the technology—after all, they understand it best—and who endorse it. Moreover, whatever doubts and disagreements the experts may have about a technology do not appear in their final recommendations.

For example, in 1983 a panel of experts recommended that women over 40 undergo annual mammograms, a finding trumpeted in the national news media. But no one told the public that the vote was very close, and that only months before the same committee, with only slight changes in its membership, had narrowly voted to restrict the recommendation to women over 50 or at high risk of breast cancer.

The issues Robin raises have come to the fore regarding the possible abuse of the test used to screen blood donors for AIDS. This test has virtually eliminated the transfer of AIDS through the blood supply. Yet the rate of false positives is reported to be around 17 percent. One can only shudder at the possible consequences for both true and false positives. Some states are considering making official reporting of the results mandatory, and requiring couples to take the test before they can receive a marriage license. Job discrimination and denial of health and life insurance are also real possibilities.

Robin is also concerned that patients often unwittingly undergo risky procedures to benefit medical research. He is in favor of this only if patients are fully aware of which treatments and tests are for their own benefit and which will benefit the public, and if they understand the risks that the tests entail. Robin insists that self-sacrifice for the common good should not be subtly coerced through intimation of cure or withholding of information.

What does Robin prescribe for the medical system? He would vastly expand the number of clinical trials of diagnostic tests before they see widespread use, and set more rigorous criteria for screening healthy subjects. He would reduce the number of hospitals and doctors, have hospitals discourage unnecessary admissions, and have physicians and hospitals monitor themselves more carefully and openly. Given his analysis of the problem, these recommendations are tantamount to asking the fox to guard the chicken coop.

Not surprisingly, therefore, Robin's chief recommendation is *caveat emptor*. Patients must be informed and take an active role in choosing their medical care. They should not submit to any procedures without asking questions about their risks and benefits and their effect on overall treatment. Robin's plea that patients become informed provokes one serious criticism of the book: it lacks references to the wealth of studies he describes. Omitting a bibliography is a lost opportunity in a book meant to help the individual confront the system's biases intelligently. □

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Corporate America's "Mission Impossible": Containing Health-Care Costs

BY REGINA HERZLINGER

If corporate health-care costs continue to escalate at their present rate, they may equal the profits of the average large company by the end of this decade. Many corporations are concerned about the threat that these spiraling costs pose to their bottom lines and their ability to stay competitive in domestic and world markets.

Corporate executives have responded to this threat by increasing their employees' share of health-insurance costs and limiting the company's coverage. Some have also instituted audits of health-care services and provided incentives for workers to obtain care at lower-priced hospitals, and at outpatient clinics and health maintenance organizations (HMOs), which receive a flat fee for serving employees' health-care needs. Some firms have even offered widely publicized programs that attempt to promote better health, including fitness classes, drug-abuse lectures, and stop-smoking clinics.

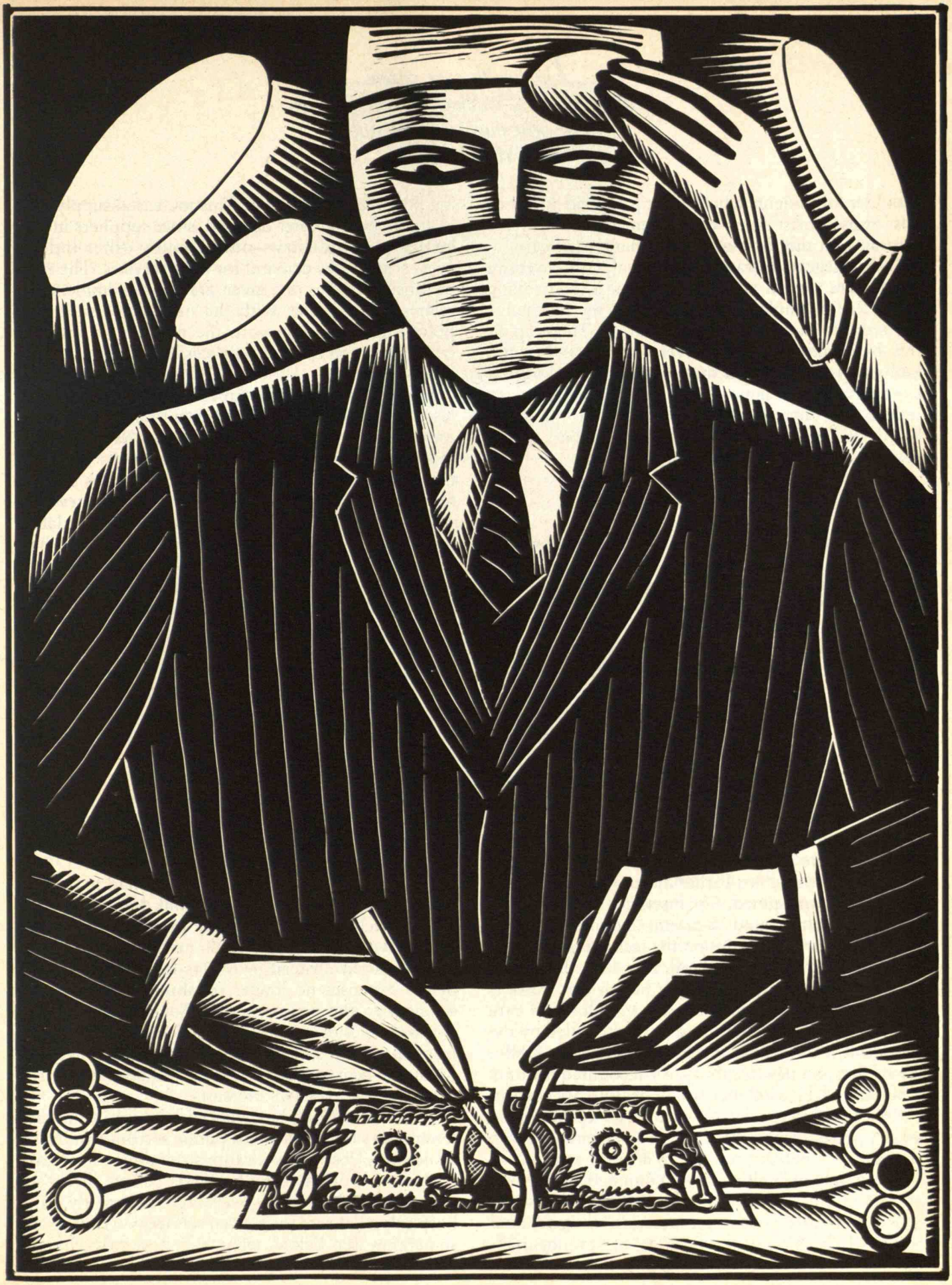
The efforts of corporate America could have a major impact on limiting health-care costs nationwide. Though by no means all of the 190 million Americans (out of a population of 230 million) who are covered by some form of health insurance work for major firms, both government and nonprofit groups will probably emulate the cost-cutting strategies that corporations adopt.

So far, however, corporate efforts to reduce health-care costs have been largely unsuccessful. Some firms have claimed victory because health-care costs rose less in 1984 than in the past. But such victory cries are premature because the lower rate of increase reflects the general decline in inflation rather than any success in coping with the seemingly inexorable rise in health-care costs.

The tactics adopted by many firms are doomed to failure because they deal with only one part of a complex, interdependent industry. The health-care system is like a lump of elastic rubber: punching down one part of it may simply result in a rise elsewhere. For example, eligibility for government programs such as Medicare and Medicaid has been tightened. That, in turn, has increased the costs that hospitals must

American firms have not been able to control runaway health-care costs. Only strategies that embrace the entire health-care system will work.

ILLUSTRATIONS: ANTHONY RUSSO



The health-care system is like a lump of rubber: punching down one part may simply result in a rise elsewhere.

shoulder for patients who cannot pay. And hospitals pass those costs along to consumers with private insurance in the form of higher charges for care.

Only integrated strategies that deal with the entire health-care system will be successful in controlling costs. For example, U.S. firms must try to change the way health care is now reimbursed. They can do this by turning to alternatives such as HMOs and lobbying for legislation that puts a cap on hospital expenses. At the same time, firms should strive to reduce the demand for care by promoting good health and increasing their employees' share of the cost for routine visits and minor illnesses.

The "Health-Care State"

Rising health-care costs are caused by three factors: increases in demand, increases in supply, and pernicious changes in our lifestyles and environment. Health insurance has fueled the increases in demand. Once a rarity, health insurance is now a commonplace feature of the American employee's benefit package: 91 percent of all corporate employees are insured through company health-insurance plans. In the last two decades, firms have displayed a greater willingness to pay for employee health coverage, and the range of services that health plans cover has broadened. The result has been increased costs: corporate employees who are insured spend more on health care than do the uninsured.

Advances in medical technology have also contributed to the increase in demand, by making possible diagnostic and therapeutic procedures previously unimagined. For instance, many couples now want ultrasound for fetal monitoring, even though the jury is still out on the technology's safety and cost-effectiveness. Overall, however, the role of medical technology in boosting health-care costs is small compared with the increase in volume of care and its price. According to statistics compiled by the Department of Health and Human Services (HHS), the reliance on new technologies accounted for only 5 percent of the total increase in health-care costs in 1984. Yet because health-care costs comprise so large a percentage of our GNP (11 percent), even an increase of 5 percent represents a lot of money.

The supply of health care—in numbers of doctors, hospitals, and other health-care providers—has also increased greatly, partly in response to rising demand and partly because of the prestige and money-making potential of medicine. This increased supply has led to an even greater demand, since suppliers in the health-care industry—unlike many other industries—can create demand for their services. The rate of tonsillectomies in a given area, for example, correlates more closely with the number of surgeons practicing there than with the number of patients who need surgery. Such unnecessary care inevitably drives up costs.

Lastly, changes in the American lifestyle over the last 50 years have altered our health-care needs. Increasingly divorced from nature, we have become less physically active and more emotionally stressed, using cigarettes, alcohol, drugs, and food as outlets for the pressures of our lives. The toll has been enormous: hundreds of billions of dollars of avoidable health-care expenses. Although health awareness has increased of late, poor habits still abound. For example, more than 35 million Americans smoke, and 16 percent are very overweight. According to a poll by *Reader's Digest*, most Americans feel they are doing a poor job of taking care of their health.

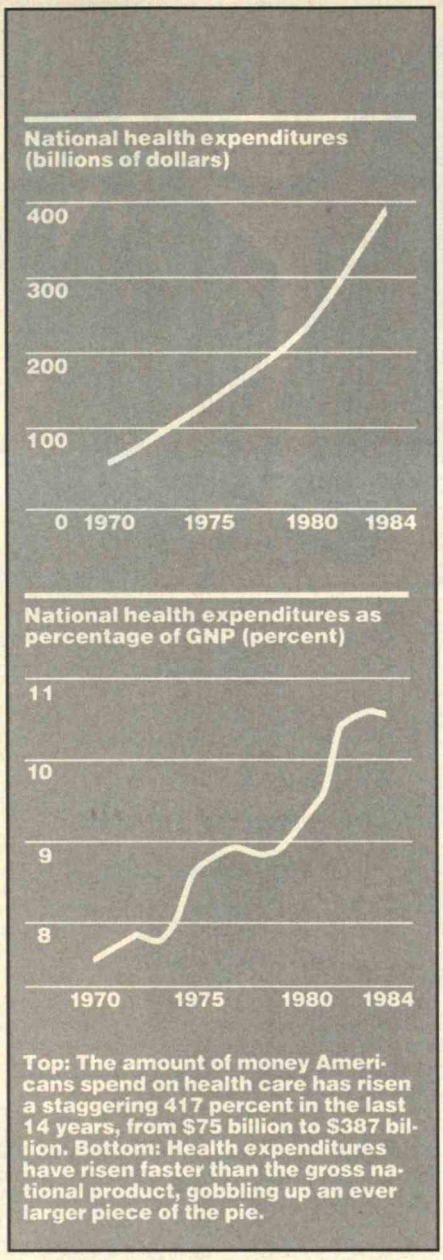
In 1984, the United States spent $387 billion on health care. The federal government paid 42 percent of those expenses, the private sector paid 30 percent, and individuals paid the rest. Pressed by horrendous deficits, the federal government has been trying energetically for many years to reduce its share of these costs. Its strategies have incluced reducing payment per service, limiting the types of services covered, and decreasing the number of people who are eligible for government health insurance.

However, these strategies have not had major effects on the nation's health-care bill. Most hospitals and physicians understandably prefer not to withhold services from individuals merely because they are uninsured. Instead providers have shifted many of the expenses no longer reimbursed by the government to the private sector. For example, many corporate retirees have health benefits from their firms that fill in the gaps of Medicare coverage. As Medicare benefits shrink, the corporate share of retirees' health expenses increases.

This cost shifting has worked because of the different ways the private and public sectors reimburse health-care costs. Corporations reimburse hospitals on the basis of what the hospitals believe their services cost. In contrast, government frequently pays hospitals a flat rate for a given service—with the rate sometimes set below what the hospitals charge.

Hence, as government reduces its payment rates and tightens eligibility for Medicare and Medicaid, hospitals are able to make up the difference by charging private consumers—or their employers—more.

In its latest attack on health-care costs, the federal government has devised a system of more than 400 diagnosis-related groups (DRGs). The government provides fixed payments based on what DRG an illness falls into. For instance, all kidney transplants are grouped in one DRG, and childhood mental illnesses in another. The average cost of treatment determines the payment for illnesses in each diagnosis-related group. The theory is that hospitals with above-average costs per diagnosis will reduce those costs to more closely approximate the DRG payment. However, hospitals could again shift costs to the private sector rather than reduce them, and this threat has galvanized many firms into action.



Top: The amount of money Americans spend on health care has risen a staggering 417 percent in the last 14 years, from $75 billion to $387 billion. Bottom: Health expenditures have risen faster than the gross national product, gobbling up an ever larger piece of the pie.

Sharing Health Costs with Employees

To find out how corporate America has reacted to this crisis, I surveyed the chief executive officers of the Fortune 500 companies, as well as those of the top 250 nonindustrial firms (including banks, utilities, and insurance and transportation firms). More than 300 executives responded in writing, and I followed up their responses with personal interviews.

The favorite cost-control strategy of many firms I surveyed has been to modify health-insurance policies. In 1980, for instance, only 5 percent of the firms' employees paid a deductible of more than $100 before insurance payments could begin. By 1984, 43 percent paid such a deductible.

Firms increased their employees' share of health-insurance premiums, too. In 1980, 53 percent of employees paid nothing for their health insurance. By 1984, only 38 percent were graced with such benefits. Many firms reduced the maximum amount of health coverage for employees. In my sample, maximum coverage dropped from an average of $1 million to an average of $750,000. Companies also reduced the number of services they are willing to pay for—they now cover fewer laboratory and radiological tests, for instance. And they increased their payments for outpatient services and home health care.

Some of these attempts to change demand involve little more than shifting costs to employees. Having employees pay more for their insurance premiums will probably not change the demand for health care. Employees make payments at one time and receive health care at another, when the payments are not likely to be on their minds.

Aware that retiree health-care expenses are a timebomb, many companies have also begun to limit benefits for future retirees. Some firms have even attempted to cut the benefits of present retirees. Not surprisingly, this has provoked a major outcry, some lawsuits, and a congressional inquiry. Clearly, tampering with retiree benefits is a risky strategy.

A number of firms have adopted flexible benefit plans that allow employees to trade health-care benefits for credits in other areas such as pensions and child care. Pepsico, for instance, offers employees benefit credits if they switch to a health-insurance plan with a higher deductible and copayment. Many employees have switched to the new plan, using their credits for retirement benefits or some other deferred compensation. Such programs are expected to cut firms' expenses because the costs of other benefits do not rise at the same rate as those for health care.

Large firms have also attempted to control the volume of health-care services. Some have set up "utilization reviews" to determine what kind of ser-

DIAGRAMS: OMNIGRAPHICS

vices their employees overuse. Others examine health-care claims and notify hospitals and doctors whose volume of care seems out of line. Sometimes firms even deny payment to such providers. Many firms also require employees to obtain second opinions on certain procedures before they authorize payment. These attempts to reshape the supply of health care have run into two major obstacles. First, there is little information on patterns of hospital care, so it is difficult to identify providers who abuse the system and to flag procedures that are overused. Files on insurance payments are massive, but they are organized to facilitate payments rather than to identify patterns of use.

An even more fundamental problem is the ambiguity of what constitutes "acceptable" medical practice. According to one Harvard Medical School physician, at best only about 30 to 50 percent of health-care services are effective, and the rest border on unnecessary care. Indeed, studies have shown that doctors perform many unnecessary tonsillectomies, mastectomies, and hysterectomies each year.

As the government reduces its payment rates, hospitals charge private employers more.

Doctors trained at different institutions may well disagree about what treatment is appropriate in a given case. But who is right? Ironically, the result of most disagreements is more care: recent studies have shown that second opinions actually *increase* rather than decrease the incidence of surgery and other procedures. The bottom line is that utilization reviews offer little immediate hope of significant cost saving.

Firms have also tried to cut costs by moving health care away from the most expensive site—the hospital—and by contracting with organizations that provide prepaid or discounted health care. Some firms will cover services such as laboratory tests only if they are done in outpatient clinics. But this strategy, like many others, may be counterproductive for the system as a whole. Outpatient insurance may actually create demand for new services rather than substituting for existing ones. Outpatient clinics that offer minor surgery at low prices have greatly increased the demand for procedures such as knee surgery and the removal of noncancerous growths.

Some companies limit payment to physicians who have agreed to discount their fees; such doctors are sometimes organized in preferred provider organizations (PPOs). But PPOs, like most other health-care providers, are paid a fee per service. This encourages them to increase the number of services they provide and to do them in the hospital—the site that generally pays doctors the highest fees.

An increasing number of firms contract with HMOs, which represent perhaps the most far-reaching attempt to change the health-care system. HMOs, which provide health care for a single, flat fee, have no incentive to increase the number of services or to place patients in hospitals.

Indeed, the number of hospitalizations per HMO patient is significantly lower than for other forms of health delivery. As a result, more and more firms are providing incentives for their employees to enroll in HMOs. Health-care experts estimate that enrollment in HMOs will grow from the present 7 percent of the insured population to 15 to 25 percent within a decade. Nevertheless, many companies are restrained in their enthusiasm for HMOs. In fact, a 1985 survey found that corporations rate HMOs as the least effective cost-control device. Why does such a theoretically successful mechanism receive such mixed reviews? The reason is that all HMOs are not alike: the term covers a wide variety of organizational structures.

The best bet for cost control lies with the "closed" HMOs, whose providers are usually salaried and restricted to serving HMO enrollees. Kaiser-Permanente and the Harvard Community Health Plan are two well-known closed HMOs. Such plans, however, have high start-up costs and break-even points, so they

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ABOUT THE COVER

***Turan Erdogan, '87, plunges into the ditch as he follows on the heels of a Bowdoin College runner during a spring '85 3,000-meter steeplechase. Photo by Henry Wu, '86 from* The Tech.**

Rush Without Alcohol? "Definitely Better This Year"

When Richard Meehan, '61, was a freshman, Rush Week (as R/O Week was called then) was a special ritual centered around alcohol. In his recent book, *Getting Sued and Other Tales of the Engineering Life*, Meehan reminisced about cocktails at TKE, beer "from the keg that was always open" at Deke, and finally "drinking and shouting and singing songs of brotherhood" when he pledged SAE.

But for this year's freshman class, R/O Week was partially "dry," a change triggered by a Massachusetts law that, effective last June 1, raised the drinking age to 21. Most undergraduates—and virtually all freshmen—were thus legally unable to drink. Dean for Student Affairs Shirley M. McBay responded to the Massachusetts law with a policy statement: "M.I.T. expects that the community will adhere [throughout the year] to state laws regarding alcohol, including those regarding the serving of alcohol to persons who are either under age or intoxicated." McBay's policy statement called for a "dry rush" from the Friday afternoon of the Freshman Picnic to the following Monday night.

Disaster Never Materialized

The statement defined dry rush as "the absence of alcohol in common areas at events during the period when freshmen are being recruited for dormitories, fraternities, and other independent living groups." Though the demand struck terror into the hearts of some fraternities, the outcome was far from the disaster some envisioned. No violations were reported, and many students and administrators felt better about R/O Week. Mark Ertel, fraternity adviser in McBay's office, called the policy "definitely a positive step. . . . I could not have been more happy with the outcome." And Associate Dean for Student Affairs Robert A. Sherwood was "amazed at the lack of complaints or incidents or violations of dry rush [policies]. . . . Dry rush did not seem to have a detrimental effect on R/O Week."

The policy succeeded at least partly because it was student-initiated. The officers of the Interfraternity Conference elected last spring, led by IFC chairman Tinley Anderson, '86, of Phi Gamma Delta (Fiji), anticipated the Dean's Office action and began working to forestall problems from the moment they took office. "We decided we were almost going to try to beat them to the punch," explained IFC R/O Chairman Kenneth Koblan, '86, also of Fiji.

While McBay was convening an ad hoc committee on alcohol and sponsoring a community alcohol forum, the IFC "internally established a policy agreeable to all our member houses," Koblan explained.

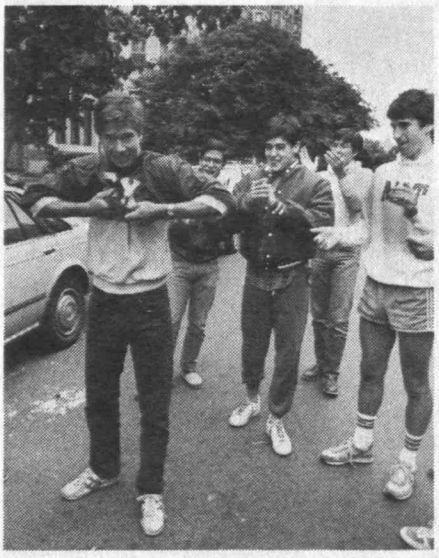
The policy statement on the use of alcohol by the M.I.T. community finally released by McBay was virtually the same as the one the IFC offered to her, Koblan said. Indeed, he believes that on this issue "there's really no way to govern us. It has to be done from within." The role of self-government is publicly recognized in McBay's policy statement: "In view of the historic emphasis on self-governance within the Institute's residential system, it is important to have a policy developed and enforced by the students."

"The policy was designed on good-faith efforts of living groups to be responsible for themselves," said Ertel. "We put a lot of confidence in our students. If we played policeman and said 'You've got a beer; throw it away,' that would compromise our role with the students."

Dry Rush or Moist Rush?

The IFC and the Dormitory Council (Dormcon) enforced the policy, and Anderson announced in advance that the

DIANA BEN-AARON, '85, IS THE ASSOCIATE EDITOR OF DATA DECISIONS, *A NEW ZIFF-DAVIS PUBLICATION THAT WILL SOON BE ON THE STANDS.*



Brothers welcome Alan Nash, '89, Sigma Chi's first pledge of the 1985 "dry rush."

IFC would treat dry rush violations like any other rush violations. Anderson, Koblan, Sherwood and IFC judicial committee chairman Linda Muri, '85, circulated through the houses during R/O. "It's a small system, and everyone knows what everyone else is doing," said Koblan. "I would have heard if someone had violated the policy."

Dormcon chose two representatives from each dormitory to monitor other dormitories for compliance with the policy. Although several freshmen told *The Tech* reporters Craig Jungwirth, '88, and Simson L. Garfinkel, '86, that they had drunk alcohol at dormitory parties, no violations of the alcohol policy were reported, according to Steve Brandwein, '86, chairman of Dormcon's Judicial Committee. "I think that, all in all, rush was definitely different this year, and better," Dormcon president Anthony Scotti, '86, commented in *The Tech*. "I don't think people got away with much."

But the policy, presently under review by the IFC and the ODSA, is still a long way from the completely dry rush advocated by the National Interfraternity Conference and adopted by many other campuses. The policy permitted serving alcohol from 8 p.m. to 1 a.m. on Saturday and Sunday nights to those over the age of 21, subject to certain restrictions designed to make sure that no under-age or intoxicated persons be served.

Most other campuses define dry rush to mean no alcohol at all throughout rush week, Ertel noted. By using dry rush to mean "no alcohol for the first four days of rush week, except two five-hour periods," M.I.T. is construing the term more loosely, he said: "I don't even call that a dry rush. *The Tech* had a good name for it: 'moist rush.' "

Fewer Free Riders

Fraternities have traditionally used alcohol as a crutch in recruiting pledges, Ertel said. He believed that without the free beer, some freshmen would never visit the fraternities. "Also, alcohol is a social lubricant; it loosens people up and makes them talk more. And fraternities often want to see a freshman in a social setting: 'If he gets drunk and stupid, we want to know now.' "

But the Dean's Office was concerned that alcohol may have been counterproductive for the living group selection process, said Stephen D. Immerman, Ertel's predecessor. Sherwood agreed that the real goal was "to do what is best for the freshmen. By enforcing a policy that would make alcohol less readily available, we could alleviate the concerns of parents, reduce the chance of being involved in liability suits, and, most importantly, protect the safety of our students."

"There's always been the educational issue of whether we should introduce freshmen to M.I.T. with all that alcohol around," said Immerman. "We were worried about presenting a wrong image of what the real world was like." Corrado Giambalvo, '86, agreed, writing in a *The Tech* column: "One does not stay drunk or party perpetually at M.I.T.,

Continued on page A12

Magazine of the Year

Our pride in the nice things people say about *Technology Review* is never well concealed, and the present instance is no exception: for the second consecutive year and the fourth time in its history, the *Review* has been named the "magazine of the year" and winner for 1985 of the annual Robert Sibley Award of the Council for the Advancement and Support of Education (CASE).

CASE is the national organization serving professionals in educational fund raising, alumni relations, and communications. The award is named in honor of a pioneering alumni executive at the University of California at Berkeley. Sibley foresaw nearly 50 years ago the role that an outstanding magazine could play in marshalling understanding for an educational institution and in drawing its alumni into its fellowship. All of the 70-some magazines entered from as many colleges and universities in the 1985 Sibley competition amply demonstrated the wisdom of that proposal. But Robert Sibley was unlikely to have foreseen what recent editors of the *Review* have learned during their stewardship of the magazine: the very positive role a loyal alumni readership can play in sustaining a magazine which pursues objectives of public as well as institutional service.—*John Mattill* □

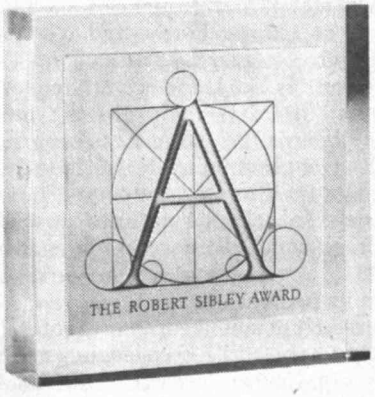


PHOTO: ARIEL POLER '88, from TECHNIQUE

Dedicated Volunteers Honored, Informed, Renewed

A rich fare of M.I.T. anecdotes and reports awaited more than 300 of the Institute's most dedicated supporters and would-be supporters at the National Alumni Conference on September 21 and 22.

Examples:

☐ When Charles Coleman, '87, went to see Educational Counselor Joel Feldstein, '47, for his admissions interview, Feldstein's big sheep dog gave Coleman a big schlurping lick from head to toe. It was a disaster for Coleman's careful pre-interview grooming that boded ill, he thought. But everything came out all right. Coleman is a consultant to Project Athena and vice-president of the M.I.T. chapter of the National Society of Black Engineers, and he works for UROP on course materials in fluid mechanics.

☐ It was a cliff-hanger, but the 1985 Alumni Fund turned out to be a resounding success—a record-breaking total of $10.1 million, the sixth million-dollar "plateau" achieved in the last seven years. Total alumni giving in 1984-85 was $25.9 million. President Paul E. Gray, '54, impressed yet again that "there are so many who truly care about this special place."

☐ Among its poineering developments, the Plasma Fusion Laboratory takes special pride in the geritron—a new microwave generator to which M.I.T. has made "significant contributions," according to director Ronald C. Davidson. Indeed, geritron designed and built at M.I.T. now holds the world's record for high power at high frquencies—175 kilowatts at 140 gigahertz—and it's now going into commercial production.

But laurels like these are not for resting on; for M.I.T. alumni they are spring-boards. President Gray says that within two years, when M.I.T. launches "a major fund-raising campaign . . . we will need to make the strongest possible case for a significant increase in endowment . . . something on the order of twice its present size."

Research challenges, too: Professor Phillip Sharp and his colleagues at the Center for Cancer Research admit that—after decades of study—no one yet knows how cells work, what differs in a healthy cell and a tumor cell. "We understand more today than we did yesterday," Sharp told his NAC audience. And the more they learn the more Sharp is convinced that there is no monolithic answer: cancer is many different problems calling for different responses.

E. Milton Bevington, '49, the Alumni Association's 91st president, opened the NAC's business meeting with his theme for the year: "We need us." By *we* he means "America, the free world, the whole world"; by *us* "M.I.T. alumni supporting and promoting an institution that continues to make an extraordinary, multifaceted difference in human affairs." The enemy is "complacency," said Bevington, and his goal for the 1985-86 year of his presidency is to help "everyone see why we need us . . . to expand the perception that our alumni and hence the general public have of M.I.T."

The first over-$10-million Alumni Fund broke some significant records, said James K. Littwitz, '42, reporting to the NAC for Peter M. Saint Germain, '48, chairman of the Alumni Fund Board. A record $1.6 million was designated for student financial aid, up 20 percent in one year. Donors of $100 or more were a record 31 percent of all donors; and the number of $250 gifts (3,200) set another record. A total of 1,800 alumni made their first contributions to M.I.T. during the year.

Critically important to these results were the personal efforts of alumni in visits and telephone calls to fellow-alumni. Over 1,000 telethon volunteers called 17,000 individuals during the year, and 50 alumni in key cities made personal visits to fellow-graduates. What was called a "super personal solicitation" program raised the median gift of a select pool of New York and San Francisco prospects from $300 to $500.

For outstanding educational counselors there were Morgan Awards, honoring the memory of George B. Morgan, '20, the "dean" of educational counselors:

☐ **Kevin Campbell,** '76, Chicago; **Leslie Cline,** '49, New York; **Wallace Couch,** '62, Seattle; **Arthur Josephs,** '28, Duluth; **Harold Spaans,** '30, Philadelphia; and **David Weiss,** '52, Silver Spring.

Harold E. Lobdell (17) Distiguished Service Awards were announced for:

☐ **Barry R. Bronfin,** '60, for oustanding leadership of alumni activities in Hartford and of his class' 25th reunion gift committee.

☐ **Karnig Dinjian,** '29, for 16 years "faithful and conscientious service" as class secretary.

☐ **John W. Jenkins,** '43, the "founding father" of the M.I.T. Enterprise Forum.

☐ **Bonny Kellermann,** '72, for leadership of her class.

☐ **Karen Mathiasen,** S.M.'71, for dynamic support of the M.I.T. Club of Boston, the Sloan School Graduate Alumni Council, and the Alumni Fund.

☐ **Edward D. McLaughlin,** '25, longtime Alumni Fund volunteer.

A sampling of the alumni honorees. Top: Lobdell Award recipients (L to R) R. Gary Schweikhardt, S.M. '73; Karen Mathiasen, S.M. '71; Bonny Kellermann, '72; and Philip M. Richardson, '59. Bottom: accepting a Presidential Citation on behalf of the Washington, D.C. Seminar Series (L to R) Peter Tarpgaard, Ph.D. '68; Duncan Allen, '72; and Mark Joseph, '64.

PHOTOS: FRANK REVI, '86

Top: Priscilla Gray, winner of a Lobdell Award, receives congratulations from Charlotte Layman, a member of the President's House staff. Bottom: Winners of Bronze Beavers (L to R), Carl Wilson, '34; Margaret Coleman, '50; Raymond Danon, '58; and Louis Stahl, '36.

☐ **Philip M. Richardson,** '59, dedicated leader of the M.I.T. Alumni Center of New York.

☐ **Lindsay Russell,** '50, for support of his class and of the M.I.T. fraternity system.

☐ **R. Gary Schweikhardt,** S.M.'73, for innovative leadership of alumni activities in the Puget Sound area.

☐ **Priscilla Gray,** for "the warm and gracious sharing of her home" for the Alumni Association's Senior Dinners.

The highest awards for alumni service, Bronze Beavers, went to:

☐ **Margaret T. Coleman,** '50, organizer of telethons and reunions for her class and leader in developing the impact and relevance of AMITA.

☐ **Raymond H. Danon,** '58, for his leadership of the M.I.T. Club of Mexico and founding the Enterprise Forum of Mexico, and contribution to National boards, including the Alumni Association Board of Directors.

☐ **Louis E. Stahl,** '36, "a dedicated volunteer (who) seeks and finds the activities that most benefit M.I.T.," in particular the "masterminding" of Class of 1936 reunion gifts.

☐ **Carl H. Wilson,** '34, for many volunteer roles with the Stein Club, Alumni Fund, Alumni Council, and the Second Century Fund, and for his pivotal role in his class' 50th reunion.

Then there were Presidential Citations for: the Boston Stein Club, in tribute to its 40 years of service to M.I.T., which included more than 250 thought-provoking meetings and raising more than $1.5 million for scholarships; the M.I.T. Club of New Jersey for 50 years of outstanding programs, Educational Council activities, and cultivation of young alumni; the Independent Activities Period (IAP) program of the M.I.T. Enterprise Forum, an introduction for students to the problems and rewards of managing an emerging technology-based company; the Washington, D.C., Seminar Series, a successful forum for examining "important science policy questions of current interest"; and the Class of 1974 for its record-setting tenth reunion gift program. ☐

Some of the NAC's key players (clockwise from top right): President Paul Gray, '54; Professor Phillip Sharp, director of the Center for Cancer Research; Michael Behnke, director of admissions; and E. Milton Bevington, '49, Alumni Association president.

Endowment, *the* Priority

Surrounded by greatness—a remarkable faculty and students that are "simply outstanding"—President Paul E. Gray, '54, says he and his university do not have "a single problem that would not be solved or significantly ameliorated by a quantum jump in endowment—to something on the order of twice its present size."

And President Gray told the National Alumni Conference in September that the Institute will move to resolve that frustration by 1987—"the biggest fund-raising venture in our history."

Gray was outspoken in his praise of both faculty and students. He cited spectacular research acheievements by "a faculty that just doesn't stop." And students who "take on an intellectual challenge just for the fun of it" while "shining on the playing fields. . . . *They* are what *we* are all about," said Gray.

There are new plans for reinvigorating the curricula, building on programs alumni know to be "rigorous . . . broad . . . bridging the gap between science and social need—an education grounded in science and the humanities, in technology and its effects on real people. . . . In short, an education for tomorrow's leaders," said Gray.

But this strength is endangered, Gray said, by M.I.T.'s high tuition coupled with inadequate financial aid resources for both undergraduate and graduate students, by its need for greater instructional support for faculty salaries, and by the lack of uncommitted resources to move decisively on new educational and research opportunities.

These problems all focus attention on the inadequacy of M.I.T.'s endowment, said Gray. M.I.T.'s funds are approximately equal to its annual operating budget. In contrast, most of the universities with which M.I.T. is compared enjoy endowments two or three times larger in relation to their annual operations.

Gray's solution is bold and direct—a major capital fund program concentrating on new endowment that will begin late in 1986 or 1987. Its goal: to provide "the capital base necessary to support the best faculty and the best students of the best university of its kind in the world," he said. "We must create an environment that enables our faculty and students to do the best, most creative, most challenging work possible.

""We are going to look to you for help in many, many ways. And we are going to succeed," Gray told an applauding alumni audience. □

PHOTOS: FRANK REVI '86

Reality As a Prescription for Politics

Following is a condensation of the Robert H. Richards Alumni Lecture delivered by John H. Sununu, '61, Governor of New Hampshire, at the National Alumni Conference on September 21. Sununu studied mechanical engineering at M.I.T., receiving his doctorate in 1966 before joining the faculty of Tufts University.

I am supposed to talk this morning about what someone from a background such as M.I.T. has to offer in public service. My answer to the question, which is an interesting one, has to be preceded by a word of caution: I have not been in politics very long; I've been governor of New Hampshire only since 1982. On the other hand, I will also say that I have done nothing since leaving M.I.T. that has given me as much satisfaction.

It is hard to explain the difference between dealing with things in the public and private sectors, but I am convinced that we who come with a technical perspective have something important to bring to political issues.

A Strong Quantitative Sense

Let me outline a little of what has happened in New Hampshire in the past three years. When I was elected, the state was regarded as the basket case of New England's economy, a state with a $50 million deficit and about the same level of economic activity and per capita income as our two northern sister states, Vermont and Maine. New Hampshire had a unique tax structure—no sales tax, no income tax—that it wished to maintain. I felt that my responsibility was to restore the system to prosperity while maintaining that tax structure, which I felt was its basic strength.

My proudest statistic is that New Hamsphire today has a per capita income of $14,700, while Vermont and Maine per capita incomes are about $10,400. That difference proves that you can in fact provide through public policy a climate that attracts investment and creates job opportunities.

Meanwhile, we have made major improvements in our service to the public. By the end of this next biennium, we will have a brand new prison system and new state facilities for those that need mental care, including a complete network of community mental health centers. We offer comparable services and facilities for the developmentally disabled, and by the end of the binennium we will have completed the reconstruction or refurbishing of all the facilities for our troubled youth.

John H. Sununu, '61

We have given the university system the largest percentage increase in budget in its history. It now has one of the highest ratios in the U.S. of out-of-state to in-state applicants. We have more than doubled state aid to the cities and towns for education, and our educational system now produces students with the highest SAT scores in the country.

We have taken over full operating expenses of the court system, and we cut out the fat. By the end of this next two years we, as a state, will have built anew virtually all of the infrastructure for the delivery of state services.

We have the most modern integrated financial system of any state in the nation. When I first took office, it was about six months before we had a clear picture of the finanical condition of the state. In contrast, I now can call up and determine the status of any account from my desk, and all the information between purchase order and invoice is literally at my fingertips. We do a pro forma closing every day.

I believe this performance demonstrates that the discipline that comes from a rational rather than an emotional approach to issues—the effectiveness, efficiency, and bottom-line mentality that are customary in private-sector institutions—can be brought to government. But let me not be misunderstood: you cannot bring that business discipline to *every* policy decision. Those that talk about the virtue of running government as a business sometimes confuse policy with operation. It is in the latter where we can bring real efficiency to public institutions.

How does an educational experience such as that of M.I.T. affect this kind of performance? One basic answer is that this institution assures high performance on the part of its students. Furthermore, we develop here a strong quantitative sense, and nobody can make constructive policy without knowing the difference between a thousand, a million and a billion.

Furthermore, the M.I.T. experience assures that one's character has been honed by the understanding that nothing really worthwhile comes easy.

The Ideal versus the Real

But beyond these things, I think there is a fundamental advantage that M.I.T. alumni bring into the political environment: they are realists, more comfortable than most when dealing with real rather than ideal systems.

In fluid mechanics, for example, there is a whole body of classic solutions associated with an ideal fluid—a fluid that has no viscosity, no internal dissipation. The tragedy is that these solutions predict very little of what takes place in the real world. When you introduce a viscosity term, you change the character of what can and can't be done.

I really believe that a great deal of the

New England is heading for serious energy trouble and not enough is being said about it by the technical people who understand it best.

difficulty we have in this world is that too many people are trying to make things work as if ours were an ideal system. We could do more for those we want to help if right from the beginning we cultivated our sense of reality—of resource allocation, for example.

Let me try to give you a real-world example. I personally believe that free trade is essential for this world. But I know that in reaching for this goal we cannot ignore the reality of the world as it is, including the needs of our people who are victims of the subtle constraints that are placed on a free trade structure by our trading partners in the world.

Limits to Adversarial Action

Another strength that a technical background brings to political life is the sense of the need for decisions, that facts can be marshalled and weighed as the basis for action. At the risk of offending friends in the legal profession, let me say that one of the greatest problems in this country is that our lawyers—of which there are too many—have brought all the weaknesses of their profession into our political processes. The adversarial process serves us reasonably well in a court setting, but it has no place in making policy.

For example, because of the legal precedent, Congress typically sets up an adversarial process for developing its position on controversial issues. It invites witnesses, and—in fairness, it says—seeks to give equal time to both sides of an issue like acid rain. Never mind that 90 percent of the air quality and ecology professionals are on one side, each side must have equal time and the same number of experts. When you have too many of these 90-to-10 instances, things happen. The same one person reappears to talk on the minority side in many hearings and often on many different issues. By virtue of these frequent appearances, that person becomes an expert: if you're the only one that can handle Issue A and Issue B and Issue C, you must have great talent. The result is that we have developed a cadre of incompetent expertise. This is a simple outcome of our reliance on the adversarial process as a fair way to develop rational decisions on complex problems. It isn't.

This is a difficult concept for people whose instinct, career training, and profession emphasize "even-handedness." But the fact is that too much policy in this country is distorted by the belief that the world is always 50-50. The problem is that we permit the debate to go on indefinitely. There should be a no-hindsight point at which we accept a decision and move forward.

Stand Up and Be Counted

There remains to be mentioned the most obvious contribution that those of us who come out of a quantitative, technically oriented environment such as M.I.T.'s can make. There are very few major issues with which we deal in the world today that do not have a technical component, and there is a great need for constructive, courageous inputs from the technical community. Arms control is an example: decisions depend critically on what technically we can and cannot do in contrast to what we *think* we can and cannot do.

Energy is another example of an issue on which the technical community must stand up and be counted. Indeed, the technical community in this country has failed miserably to meet this obligation.

Think of the Seabrook power plant, whose cost by present estimates will be $4.4 billion. Assuming 40 years of useful life and a 70 percent operating cycle, that is about 1.4 cents per kilowatt hour of power generated. But the interest on $4.4 billion will come to 7 or 8 cents a kilowatt hour. In New England, we pay 9 cents a kilowatt hour now. The real issue at Seabrook is why we as a nation tolerate the kind of delays that have plagued Seabrook's construction and that have so disastrously affected its economics. That is what I mean by the importance of having a quantitative sense.

There are some other numbers in the Seabrook case that need to be examined in the same way. This region (New England) thinks it has 21,000 megawatts of electric generating capacity. But the industry talks about that much capacity only because its regulators demand that utilities include everything but the kitchen sink in the calculation. The total in fact includes 4,000 to 5,000 megawatts of capacity in plants that are 40, 50 and 60 years old, held together by baling wire; it is unconscionable in my opinion to consider them as part of the capacity. What's really available at the plug is generally about 16,800 megawatts. Normally, for about ten days every year we need more than that. This summer when we used 17,000 megawatts of power we were perilously close to brownout and possibly blackout. When New England utilities discuss this, they say their strategy for hot days is to buy 150 megawatts of power from New York State. And New York State on those same hot days turns out to be planning to buy 200 megawatts of power from New England.

Furthermore, if electricity demand grows at 3 percent a year, we will need another Seabrook every two years. And here is another number to think about: assuming a 40-year life, you need to replace 2.5 percent of generating facilities every year—another new Seabrook every two and a half years. (Last year Massachusetts electric use grew at 5 1/4 percent a year.) New England is heading for serious energy trouble and not enough is being said about this by the technical people who understand it best.

Despite—or perhaps because of—the opportunity to confront irrationalities such as these, I have enjoyed my three years as governor; I will probably run for another two-year term. I don't mean that as any kind of an announcement. It is simply a way of saying that I'm having a good time at it, and I believe I am able to contribute.

I urge you who have the sense of numbers, action, and management that is so essential to become involved. You will do very little in this life that gives as much satisfaction to you, your families, and society as a whole. □

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Jeri Ikeda, '87, scored game-winning goals against Wellesley College in leading the women's soccer team to a 3-2 record through its first five games.

Dormitory Shortage Prompts Smaller Class

A housing crisis in the greater Boston area—soaring rents and condominium conversions—and a lower-than-expected "summer melt" among students admitted to the Class of 1989 added up to a housing crunch for undergraduates last fall.

As the fall term began, 195 rooms in Institute houses were "crowded"—that is, were accommodating more students than they were designed for. In all, some 500 undergraduates were affected. (An example of this year's problem: ten lounges in MacGregor House have been turned into double rooms—"very undesirable," admitted Robert A. Sherwood, associate dean for student affairs.) In addition, 60 upperclassman who wanted dormitory housing could not be accommodated.

The overcrowding had two causes, says Sherwood. Early in 1985 he anticipated that less than 1,990 upperclassmen would claim dormitory space last fall, but 2,049 did so. And the Class of 1989 numbered 1,062, which was 37 more than the target.

Bad news, said President Paul E. Gray, '54, promising, "We're not going to have this again." Admissions to the Class of 1990 will be reduced to sharply curtail overcrowding next fall, he said.

Sherwood said he was "surprised and delighted" by Gray's decision. The president minimized the effect on tuition income, noting that losses from the Class of 1990 will be offset by the extra tuition from the larger-than-expected Class of 1989. Gray is more concerned, he says, about having "more unhappy people who wanted to go to M.I.T. and couldn't" next fall.

Both Gray and Sherwood agree that—whatever the need—M.I.T. has no present plans or resources for increased housing for undergraduate students. The only exception is the search for a house for M.I.T.'s chapter of Alpha Phi sorority. □

Kerrebrock Is Dean

Jack L. Kerrebrock, an expert in aircraft and spacecraft propulsion systems who has been head of the Department of Aeronautics and Astronautics since 1978, is now associate dean of the School of Engineering.

Kerrebrock joined the M.I.T. faculty in 1960, four years after he received his doctorate from Caltech. He was director of the Gas Turbine Laboratory for 10 years starting in 1968, and he had a two-year leave of absence from 1981 to 1983 to be NASA's associate administrator for aeronautics and space technology.

In his new job, Kerrebrock succeeded Professor Herbert H. Richardson, '53, who is now dean and vice-chancellor at Texas A & M University. □

The Japanese Connection

The Department of Humanities' first Japanese language course was an instant sell-out this fall: 70 students applied.

From these, Professor Michio Tsutsui selected 20 to register for credit—the maximum that can be taught effectively, he thinks, in a single section. All have special need and motivation to learn this difficult language, says Tsutsui—mostly because they have plans to study or work in Japan.

Until this year, M.I.T. students who wanted to learn Japanese enrolled as exchange students at Harvard or took special summer studies outside of Cambridge. □

Soccer Success

A good omen: women's soccer—M.I.T.'s newest entry in intercollegiate sports—opened with a victory in September, 1-0 over Wellesley, and at press time the team had a 5-5-1 win-loss and tie record.

Jeri Ikeda, '87, scored the historic first intercollegiate goal for M.I.T. with an assist from Grace Saccardo, '86. Ikeda, Saccardo, and Marjorie Bump, '87, are serving as tri-captains this first-ever season.

The first week was a hectic one—five games in six days. But Coach Shawn Ladda's team came through in fine style by posting a 3-2 record. After the Wellesley contest, M.I.T. lost to Smith College (1-0) and Mount Holyoke (2-0) in the Seven Sisters Tournament at Mount Holyoke. Then they won two straight games against Colby-Sawyer (4-1) and Salem State (3-2) in the home opener. □

PHOTO: KEN CERINO

Delft Defended

TO THE EDITOR:

It is reassuring to hear that there are still professors at M.I.T. who take their teaching responsibilities as seriously as did some of my professors when I was an undergraduate and graduate student at M.I.T. in the 1960s. Professor Walter Lewin (May/June, 1985, pages A10-A12) must be an extraordinary man indeed, if he (and the Department of Physics) can afford to devote 70 hours per week of his time in preparation for 8.02.

Professor Lewin should not, however, jump to the conclusion that his teaching style did not benefit from his education at the Delft University of Technology. Further, if it was ever true that "in Holland the faculty are lousy lecturers," then I submit that Professor Lewin is in no position to judge the veracity of that statement for the present generation of faculty members. Twenty years away from Delft is a long time. While Professor Lewin's mentor (S.M. work, 1960) and promoter (Ph.D. work, 1965) is still associated with the faculty, 90 percent of the faculty in the Department of Applied Physics in Delft has been appointed since then, with 50 percent in the last five years.

While I remain thankful for the many inspired teachers I had at M.I.T., I cannot say that they were all uniformly excellent or even good. Some worked much better and had the greatest influence on me through one-on-one contact rather than by lecturing in front of 350 students. The same situation holds in Delft. Neither school has a "lock" on either good teachers or good students.

Ian T. Young, '65
Delft, The Netherlands

The writer is a professor in the Department of Applied Physics, Delft University of Technology.

Professor Lewin responds to Professor Young:
Please do appreciate the fact that I did not write the article to which you refer. You seem to be upset about the statement attributed to me that "in Holland the faculty are lousy lecturers." When I read that sentence at the end of March, I called Susan Lewis (who wrote the article) and asked her to change it together with two other inaccuracies. She told me that it would be difficult since the article was past the proof stage, but she would try. Apparently she did not succeed.

When I was interviewed by Susan Lewis, we talked about my days in Delft, some 25 years ago. At that time, one or two of my lecturers were pretty good, but by and large my teachers were poor educators. Clearly this is no reflection on the present situation in Delft.

In my opinion, too many physics professors at M.I.T. are also poor undergraduate lecturers (although some are outstanding). It is very easy to verify this unfortunate fact: students are asked after every term to evaluate their courses and the professors who teach them; the results are published.

I remember very well that in the interview, my unhappiness with the undergraduate teaching in the Physics Department at M.I.T. was expressed loud and clear. This is a painful and somewhat "taboo" subject. Poor presentations (teaching, conferences, and colloquia), in general, are common. One way that we could make a modest start to change this is to teach the students (in a regular course) how to teach and how to give a talk.

You write: "Neither school has a 'lock' on either good teachers or good students." I fully agree with you as far as the teachers are concerned. But I would have expected you to notice a difference in quality among the students at Delft and at M.I.T. This is not surprising since M.I.T. is a private school and can be selective.

Walter H.G. Lewin
Garching, W. Germany

NOTE: Professor Lewin is on sabbatical at the Max-Planck Institute for Space Physics near Munich.

and to a certain extent, that was the impression we gave during rush, wasn't it?" John F. Piotti, '83, dissented, arguing that some fraternities are "drinking houses" and truth in advertising dictates that freshmen should see that during R/O Week.

When alcohol has been served during past R/O weeks, brothers were not allowed to drink because they had to make certain decisions, Ertel commented. "It was there for the recruits. And I said, 'Why have it at all? Don't you want the freshmen to be as levelheaded as the brothers?' But the crutch was, 'We've always done it this way.' "

Some houses reported that not as many people visited this year, Ertel said, but he pointed out that the weather, which forced even the Freshmen Picnic inside, kept many freshmen on the Cambridge side of the river. "Partly the lower numbers mean that there were fewer 'beer suckers,' free riders who drink beer at the fraternities but have no intention of joining an independent living group," he said.

The Dean's Office also got a handful of complaints that "This frat or that dorm had beer, but we played by the rules,' from houses that wanted to blame someone else for their lack of success' " Ertel noted. "And some students, who weren't involved with the IFC or Dormcon, were dissatisfied because they felt it wasn't their policy."

"Those who counted most heavily on alcohol in the past had the most to relearn," Ertel observed. "Instead of sitting in the frat house by the keg waiting for guys to come by so they could get them to pledge, the actives found they had to work at it."

But as a result of their work, Ertel said, the previously alcohol-dependent fraterities "are going to find more people who are quality individuals and who are looking seriously at a place to live for four years. That is the scenario the vast majority of groups have brought to me this year when they gave me positive comments on the alcohol policy: They're going to get fewer 'beer suckers' and more quality M.I.T. students." □

15

The response from our special 1915 Newsletter has been wonderful, and at this very moment we are going to up-date the Newsletter, as some '15ers have sent in more information about themselves and also **Bob Warren** has informed me he is having prints made of some of the Alumni Day pictures, and we are planning on sending three photos to each classmate. By the time you read this column this will have been accomplished. Thanks again for all your cooperation—otherwise compiling the Reunion Class Newsletter couldn't have been done.

Before a little more nostalgia, I must first extend our sympathy to Viola M. Hobbs, who wrote many months ago, advising us of the death of **James B. Hobbs**. He was at M.I.T. for two years—1912 and 1913. He then finished college at Brown, Ph.D. in 1918, and was in World War I just after graduation. His Tech years were at the old Rogers Hall! He enjoyed his years there. He lived in a room on Mass. Ave., and paid $1 a week for that privilege. How times change!

Now, going to more of **Loring Hall**'s diary, which everyone is truly enjoying.

February 11, 1914: Today for the first time, we had Banking and Finance. Also the new courses in Railroad Engineering and Structures. Later Professor Hayward gave a lecture on Testing Materials. Walked to the station with **Joe Livermore**. He is a nice guy. Had my skates sharpened—15¢.

February 12, 1914: The new courses starting today were Geodesy with Professor Hosmer, Highways by Professor Breek, and Structural and Field Geology.

February 14, 1914: In the M.I.T.-Harvard wrestling match, Tech won 6-1. **Captain Kelly** was the star performer and **"Brute" Crowell** did a good job on his man. Sat with **Ed Goodell, O.R. Freeman** and **Alfred Nye**.

February 17, 1914: After our lecture on Testing Materials I attended a meeting of the officers of the Civil Engineering Society to make plans for the new term. **Lloyd Chellman** was there. Went tobogganing after supper. Met **Pickering** there and went over the bumps with him several times. We finally got all the way down without a spill.

February 18, 1914: Had a recitation in Banking and Finance in which we practiced making plots of surplus reserves of N.Y. City banks. It was tedious but interesting. Next came Testing Materials Lab. Worked with **John Hyneman** and **Howard King**.

February 19, 1914: After two hours of Geology in the afternoon **Dick Hefler** and I went over to the bowling alley on Columbus Ave. He won the first string. I won the second, and we tied 81-81 on the third. My highest was 105 which is the best I have ever had.

February 20, 1914: Finished my R.R. calculations, only to learn that the whole thing was wrong. Eight hours' work down the drain! Went to the last of the T.M. lectures by Professor Harrison Hayward. He is certainly a live wire and a fascinating lecturer. After supper went back to the Union and heard "Pa" Coburn give a talk on "Rambles of a Dam Builder." After that Dick Hefler and I went to the "M.I.T. Military Hop" at Horticultural Hall and came home with **Pinkam** and **Tobey**.

February 24, 1914: Had our first laboratory exercise in Testing Materials in which we tested the qualities of a bar and of open-hearth rivet steel. It was interesting.

March 2, 1914: Lecture and demonstration by Mr. O'Neil on foundry work. Later, a compression test on timber, using the 300,000 pound Emery tester. Learned a lot about the properties of spruce and of long leaf yellow pine.

March 9, 1914: **John Gallager** and I spent all afternoon in the E.E. lab trying out a new experiment "The Parallel Operation of Compound Generators." Very tricky. Not too successful.

March 10, 1914: This is Katherine's 18th birthday. Had meant to get her a present, but am dead broke.

March 17, 1914: In Testing Materials Lab we tested some slabs made by a previous class, then mixed some concrete for the next class to test. It was very instructive.

March 18, 1914: Dr. Sargent filled a back tooth with amalgam. Then at dinner it broke. Fine! Sold $15.50 worth of last summer's left-over aluminum ware. The dough will come in handy for Junior Week.

March 20, 1914: Had R.R. Drawing all morning, then went to lunch at PSK with Professsor Breed. He gave me some good advice. Spent a couple of hours at the Truck Show in Mechanics Building. Went home on the street car with Laura Palmer. Had a lot of talk but little conversation.

March 24, 1914: In T.M. Lab we tested a 6" I-beam as a column 45" long. Recorded a lot of data for use later. Called on Kay in the evening. She was as pretty as a picture. I didn't make much headway!

March 26, 1914: **Seward Highley, Ted Friebus** and I had lunch, then took the 1:35 train for West Quincy with Mr. McKenzie and the rest of the class. Bought a book of 12 railroad tickets and made a little profit on it. We visited a granite quarry, a porphyry ledge and a glaciated lamination. Interesting, but hot.

Thanks again, **Loring,** and in our next issue we will finish "Junior Year" at M.I.T.! When typing this the warm weather is still upon us; however, this will be our holiday issue, so of course, Happy Thanksgiving, Merry Christmas, and Happy New Year. With my warmest regards and love throughout the holiday season, and always!—**Joyce Brado,** Acting Secretary, 491 Davison Rd., Apt. 9, Lockport, NY 14094

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Nat Warshaw's son, Stan writes, "I thought some of his classmates might like to have my father's address, which is: Plymouth Harbor W201, 700 John Ringling Blvd., Sarasota, FL 33577. He asked me recently to tell his friends that he is 91 and in as good health as he was ten years ago. He walks several miles each day, eats three good ones, and gets plenty of sleep. He does miss seeing his friends up north and wishes that he could hear from them. He is a good salesman for Plymouth Harbor and would like to see others join him there! I can vouch for the fact that Plymouth Harbor's 'independent living' is most effective in adding years to lives." . . . Had a nice letter from **Dan Comiskey** tellig us that he and Grace are doing well.

Receiving letters from you is the key to the success of this column. We heard from two of you this month. That means that there are another 45-50 classmates from whom we did not receive letters. Let's improve the average for next month. Keep writing. Keep well. Continue to contribute to the happiness of others.—**Bob O'Brien,** Acting Secretary, H.E. Fletcher Co., Groton Rd., W. Chelmsford, MA 01863

18

I am indebted to **Herb Larner** for the following account of his first experience after graduating in 1918 at our alma mater in the biology and public health department. Quite unknown to him, Professor William Sedgwick, arranged for his appointment as a scientific consultant in the U.S. Public Health Service in the Muscle Shoals District in Alabama. Shortly thereafter, a smallpox epidemic broke out in Cullman County, Alabama—and Herb was chosen to take charge of the situation.

He writes: "With five public health nurses from headquarters in Florence, I set up shop in the Excelsior Hotel in Cullman. The hotel was well-named—a fire-trap if there ever was one. I composed a lecture on the etiology and epidemiology of smallpox and with my corps of smart looking nurses we went on a 'Medicine Man' tour of Cullman and surrounding counties. Hordes of people from every middlesex, village and farm came to hear the 'government doctor' speak. Whole families would come bringing their lunches, in many cases. I spoke in schoolhouses, public squares, on hastily erected platforms, on hillsides—any place where we could get a crowd of people together.

"Our 'medicine man' act was a great success. I would give the people my spiel on smallpox and then we'd invite the crowd to line up and get protected. We kept no records or issued certificates of vaccination. There wasn't time for ceremony. We just grabbed people right and left and vaccinated them. We kept it up every day for about two months including Sundays. Practically everyone in Cullman County and surrounding places got vaccinated. We didn't know how many, but it must have run in the thousands. After a couple of months, during the winter of 1918-19, there were so many people protected, that the smallpox epidemic, with nobody to fuel it, burned itself out and my nurses and I went back to headquarters in Florence.

"That was my first job, over 67 years ago, just out of Boston Tech and so I say, with all due modesty, I trust, that if the World Health Organization claims that smallpox has been wiped off the face of the earth, my nurses and I played significant roles in the demise of that horrible dis-

ease."—**Max Seltzer,** Secretary, 865 Central Ave., North Hill Apt. B403,Needham, MA 02192; **Leonard Levine,** Assistant Secretary, 599 Washington St., Apt. 15, Brookline, MA 02146

19

A few days ago the mail brought me a lovely letter from **Francis A. Weiskittel** who resides in Baltimore, Md. He will be 87 years young on September 7 this year and despite the usual infirmities common to most of us this age, Francis continues to be active. He recalls with pleasure his Course XV classmates, **Louis Grayson, John Riegel** and **Leon Snow**. He recalls as well **Oscar de Lima, Charles Drew,** and **Don Way**. These are the memories that this column aims to keep alive. Most every year in November, Francis and his son go to Disney World and he's young again and aims do so again this year. We were pleased to receive his warm letter and I'm sure we all wish him well.

Don Way and his wife Barbara sent me a postcard from one of their favorite vacation spots in New England where they go to enjoy themselves each year. Don recalls that in past years he used to meet by chance another Course VI graduate, **Ellsworth Patterson**. This reminds me of the summer when a group of students were employed by the Institute to move everything from the Boston buildings to the new ones in Cambridge. Patterson and I were members of the group and we all had a wonderful time turning work into play.

Lest some reader be misled, I must correct an error in our Class 1919 notes concerning **Doc Flynn**. Doc walks around two miles a day to keep fit and in the July notes I, in error, wrote two miles per week. Please excuse my silly error.

An Alumni Association notice and a newspaper clipping reports the death on May 10, 1985, after a brief illness of **James G. Strobridge**. His residence was in Southbury, Conn. He served in World Wars I and II and retired as a colonel. He was the retired chairman of the board of the Strobridge Lithography Co. in Cincinnati. He is survived by his wife Lydia Strobridge. We recall him at the Institute and at reunions of our class and we shall miss him.

Hope these notes find you all well and enjoying our changing world.—**Bill Langille,** Secretary, Box 144, Gladstone, NJ 07934, (201)234-0690

20

Harold Merriman was featured in an article in the Quincy *Patriot Ledger* recently. A veteran of World War I, he participated in the Memorial Day parade and dressed in his "dinky uniform," the same one he wore in 1920. A native of Canton he is a charter member of the American Legion Post in that town and served as post commander in 1925. A picture accompanying the article indicates that he is hale and hearty. More power to him.

Captain **Russell S. Hitchcock** of Sheepscott, Maine died early last year. No details. . . . Professor Emeritus **Louis Harris** died on May 28. He was a member of the faculty from 1938 until his retirement in 1963. He lived in Weston, Mass., and was the author of a treatize on chemistry published within the year.

Your secretary would like to hear from you.—**Harold Bugbee,** Secretary, 702 Country Club Heights, Woburn, MA 01801

21

It is saddening to report seven deaths this month but time is marching on for the class of 1921: **Roy J. Roy** of Lexington, Ky., during 1982; **Robert J. Lawthers** of Puyallup, Wash., on February 16, 1985; **Preston W. Smith,** of North Weymouth, Mass., on January 1, 1985; **Philip M. Johnson,** of Portland, Me., on March 14, 1985; **Alan Osbourne,** of Bethesda, Md., on May 18, 1985; **Norman E. Ferguson** of Newton Center, Mass., July 7, 1985; and **Mark V. Hamburger** of Brookline, Mass., on August 8, 1985.

Preston Smith was professor of physics at Clarkson College of Technology from 1943 to 1956 after which he was professor of mathematics at St. Lawrence University until his retirement in 1966. He was a retired U.S. Army captain and briefly attended Harvard before going to West Point, where he graduated in 1918.

Colonel **Philip M. Johnson** served in France in both World Wars and received the highest award given by France to a foreigner, the National Order of the Legion of Honor. During World War II, he commanded a battalion of the 45th Division at Anzio, Italy and later at the invasion of southern France. He held degrees from both Bowdoin College and M.I.T.

Alan Osbourne was a naval architect and marine engineer who worked for the old U.S. Maritime Commission. He was born in American Samoa where his father was a government official. He earned degrees at both Pomona College and M.I.T. and served in the Army in World War I. During World War II he worked on sonar buoys used to detect submarines. Alan was an editor of *Modern Marine Engineers Manual,* a standard work.

I am indebted to Leonard Levine, assistant secretary of the class of 1918, for a note and newspaper clipping concerning the death of **Mark Hamburger**. Your secretary had known Mark in undergraduate days in Course X and in recent years ran into him at Simmons College reunions. Len Levine reports that Mark spent most of his career as an executive for several large department stores. He was an army officer, serving in Panama during World War II.

I have no other news to report this month except a personal note that I took a two-week vacation at Squam Lake, N.H., during July. Hiking, swimming, canoeing, and elbow bending were the order of the day. There were many old friends in camp, which made my first vacation since moving to Albany a good one.—**Sumner Hayward,** Secretary, Wellspring House E64, Wash. Ave. Ext., Albany, NY 11203; **Josiah D. Crosby,** Assistant Secretary, 3310 Sheffield Cir., Sarasota, FL 33579; **Samuel E. Lunden,** Assistant Secretary, 1149 S. Broadway, Suite B-800, Los Angeles, CA 90015

22

In the last issue of the *Review,* I noted in the class notes the death of **Bill Mueser**. Since then I have received more details about his illustrious career which bear repeating. This is from *Holing Through,* the news bulletin of the Moles. "Mr. Muesser retired as senior partner in the firm known currently as Mueser Rutledge Consulting Engineers on December 31, 1975. A native New Yorker, born on April 10, 1900, he obtained his engineering degree from M.I.T. in 1922; and did graduate work at Technische Hochschule in Berlin, Germany. He joined the firm then known as Moran, Maurice & Proctor in 1923 and rose through the ranks to become a partner in 1935. Mr. Mueser's contributions to the art and science of foundation engineering were known worldwide and his reputation for excellence resulted in requests by other engineers and contractors for personal consultations. His career spanning over 50 years in the heavy construction field covered design and supervision of a variety of projects, including deep building and bridge foundations, graving docks and other important marine projects, highway subsurface engineering, underpinning and subway work. Deep foundations for bridges was a apart of his firm's work during his association and leadership. Two of note and which established records are the San Francisco-Oakland Bay Bridge and Huey P. Long Bridge in New Orleans. The latter stands in 90 feet of open water and its foundations reach depths of 185 feet. Both depths were records when the bridge opened, but were far exceeded only a year later by the San Francisco-Oakland Bay Bridge. Water depths of up to 120 feet were surmounted on the San Francisco-Oakland project and its piers were sunk to maximum depths of 242 feet. Bill Mueser's dad was a pioneer in reinforced concrete construction during the 1890s and early 1900s specializing in the design of concrete bridges and both his sons, Bill Jr. and Bob are engineers following their own careers in construction. He received many awards over the years. In addition to The Moles' Member Award for 'outstanding achievement in construction' which he received in 1975 and which Bill considered a 'highlight' in his career, he was designated an honorary member in the American Society of Civil Engineers during 1978, and was a member of the National Academy of Engineering."

Notes were received from **George Dandrow** and **Horace McCurdy** both commenting on **Bill Mueser**'s outstanding character.

Bill Elmer is still up and about, physically OK, cutting his lawns and headed for Europe in September. He recently designed two reflectors for Westinghouse Oceanic Division in Annapolis. Recent conversations with President **Parke Appel** and **Ab Johnson** showed that they are well. Ab visited with Fritz Clement, '23, in Florida last June 15, the birthday of both in 1899.

Theodore H. Elliott died August 12, 1985 in the Beverly, Mass., Hospital after a heart attack at age 84. Ted was involved in the development of the first jet engine at the G.E. Company in Lynn and Baltimore and in the design of the old China Clipper of the 1930s and World war II B-25 and B-27 bombers. After retiring in 1960 he moved to Manchester, Mass., where he bought and operated the Lodge Apartments. He was a ham radio operator, a member of the American Radio Relay League, an enthusiastic sailor and at one time a manufacturer of ski equipment. He was a member of Beta Theta Pi, a charter member and first secretary of the Jet Pioneers of America and past member of the William Parkman Masonic Lodge in Winchester, Mass., where he lived until moving to Manchester. He is survived by his wife Louise, a son, Theodore H., Jr., and two daughters, Jennie L. Brockelman of Winchester and Barbara M. Cronin of Princeton and eight grandchildren.

Colonel **Thomas H. Nixon,** Course II died May 21, 1985 at York, Pa. He is survived by his wife Aimee. No other information available. . . . **Bjarne Colbjornsen** who was a special student from Stockholm died July 11, 1984 in Helsingborg, Sweden, at age 90. He is survived by a son. . . . **Roland L. Smith,** Course VI-A, died in 1984 in Delray Beach, Fla. He is survived by his wife, Elsa. . . . **Morrill Thornton Dow,** Course VI, died earlier this year in Carlsbad, M.Mex. The information comes from Wallace T. Dow, who I believe, is his son. Our condolences are extended to the families of these deceased classmates.—**Yardley Chittick,** Secretary, Box 390, Ossipee, NH 03864

23

Due to the lack of space in the *Review,* my October classnotes had to be held over until this issue. There is much to report.

Al Pyle writes from Wilmington, Del. that he has been elected to the buildings and grounds committee of nearby Riverside Hospital. He specializes on preventive maintenance. Last Spring he and his sister Vicki, his daughter Cynthia and her husband enjoyed a 14-day tour of Egypt.

Robert Sprague has been elected to the National Academy of Engineering for invention of electronic components and for entrepreneurship in founding a major electronics company which he directed for 58 years as president and chairman. He now is honorary chairman, Sprague Electric Co., North Adams, Mass.

Charles Ducote died April 16, 1985. He took a B.S. degree at Spring Hill in 1918 and graduated

with our class in electrical engineering. Upon graduating he was employed as an assistant electrical engineer for five years by Stone & Webster, Inc. of Boston. He began international assignments with the United States Trade Commission in Buenos Aires, Argentina, between 1928 and 1931 and then with the Bureau of Foreign and Domestic Commerce in Washington, D.C. until 1935. During this period of service with the Department of State, until 1951, he was stationed for long periods of time and traveled widely in many foreign countries throughout Europe and South America, and acted as business representative for Celanese Corp. of America, and for the Pullman, Inc., subsidiary, Trailmobile. He also traveled considerably in Japan, Australia, and other countries, in the establishment of licensing arrangements with foreign firms. He was director, Societe des Francais des Romorques Trailor of Paris, vice-president and general manager, Trailmobile International, Inc., member, American Academy of Arts and Sciences, American Institute of Electrical Engineers and M.I.T. Club of New York. His hobby was piano music.

James A. ("Pete") Pennypacker has moved to Florida where he is growing oranges. His address is 1327 Young Ave., Clearwater, 33516.

Ronald Brown died on May 15, 1983. He graduated with our class in business and engineering administration and spent his entire career with the New England Telephone and Telegraph Co. until his retirement in 1963. During World War I he served as a lieutenant in the United States Army. He was very active in civic affairs in Lexington, Mass., where he was a member and past president on the Hancock Men's Club, a town meeting member, an historical society member and had served on a number of town committees. He was also the clerk for the Lexington Taxpayers Association and a Trustee of the Lexington Savings Bank. In 1964 he received recognition for 50 years of membership in the Hancock Church of Christ. His services at the church included deacon, teacher, superintendent of the Sunday school and representative to the Council of Churches.

Roy Cowdrey died sometime in 1982. He graduated from the U.S. Naval Academy in 1919 and entered the Institute in 1922 and received his S.M. degree in naval construction in 1923. Until his retirement in 1956 he was largely engaged in naval construction involving design, building, repairing and altering U.S. Naval Men of War. In 1947 he was promoted to the rank of Rear Admiral. He received many honors and awards. After retirement from active service he entered civilian life as assistant construction superintendent and contract superintendent of ORMET Corp. He left that position in 1959 and from 1960 to 1966 was general manager, Department of Marine and Aviation, City of New York. He was an honorary member of the Brooklyn Chamber of Commerce and a member of the Rotary Club of Brooklyn, and had membership in many social clubs and fraternal orders.

Clyde Doolittle died February 22, 1985. He studied biology with our class. We have no record of him.

Tom Drew died May 5, 1985. At our 60th Reunion he was elected third vice-president of our class. He graduated with our class in chemical engineering and took his S.M. degree in chemical engineering practice in 1924. He started his career as an assistant in the research laboratory of applied chemistry at the Institute and after a year became an instructor in chemistry and chemical engineering at Drexel Institute of Technology for three years. He returned to the Institute in 1928 and was an instructor until 1934, when he joined E.I. DuPont in Wilmington, Dela., as a chemical engineer for six years. In 1940 and for the next 25 years he was at Columbia University as professor of chemical engineering; chairman of the department of chemical engineering, and technical director of the Atomic Energy Commission's heat transfer facility at Columbia. During this period he returned to the Institute as visiting professor, 1959-60, and in 1965 again went back to the Institute, becoming professor of chemical engineering, emeritus, in 1967. He was the 1937 winner of the Walker Award of the American Institute of Chemical Engineers. He was a consultant to the Brookhaven National Laboratories and to the Atomic Energy Division of the DuPont Co. He was a consultant to the Ford Foundation in New Delhi and program specialist for the Birla Institute of Technology and Science in India. While living in Temple, N.H., he was a school board member and was former Peterborough Unitarian Church president, trustee and finance committee member. His hobbies were stamps, horticulture and mathematics. **Royal Sterling** has named **Howard Russell** to replace Tom as third vice-president.

Melvin Molstad died on May 12, 1985. He received a B.A. degree from Carleton College in 1920, graduated with our class in chemical engineering and later took a Ph.D. degree at Yale. After graduationn he was employed in process development by the U.S. Department of Agriculture and by E.I. DuPont DeNemours and Co., Wilmington, Dela. In 1926 he became instructor, then assistant professor at Yale. In 1939 he became associate professor, then professor, then emeritus professor at the University of Pennsylvania. He served as consultant to W.R. Grace and Co. for over 30 years. He enjoyed mountain climbing and hiking, playing the piano and pipe organ.

William O'Shaughnessey died July 22, 1984. He studied courses in biology and public health with our class, then entered the fertilizer business with Royalton Basket Co. of Middleport, N.Y. In 1945 he became secretary/treasurer of the Cotton States Fertilizer Co. in Macon, Ga., and continued in that capacity until retiring in 1966.

Lewis Powers died sometime in 1985. He graduated with our class in mathematics. After graduation he became a broker with Tifft Brothers and with Paine Webber, then left that field and joined the Powers Paper Co. where he became works manager, vice-president and director. He was director and vice-president, Hampton House, Inc. furniture dealers. He was a corporator, Wesson Hospital, and chairman M.I.T. Alumni Fund in eastern Massachusetts. He enjoyed sailing, game shooting and fishing. He was a member of the Isaac Walton League of American, Inc. and a member of the Tennis Club; governor, vice-president and president of the Colony Club.

Milton Orwin died December 11, 1984. He graduated with our class in business and engineering administration. He was vice-president of Orco Products of Dayton, Ohio, manufacturer of skirt markers and related home sewing items for 17 years; vice-president Kalamazoo Pant Co. for 37 years; and president of 14 Redwood and Ross retail stores for 15 years until his retirement in 1968. He was a trustee of Bronson Methodist Hospital; chairman, Kalamazoo Community Chest Campaign; honorary member, Kalamazoo Chamber of Commerce and the Kalamazoo Country Club; and member of Rotary Club and Park Club. He was president of Temple B'Nai Israel. He enjoyed music, golf, and bowling.—**Richard H. Frazier,** Secretary/Treasurer, 7 Summit Ave., Winchester, MA 01890

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A note from **John Black** in Bristol, Tenn., reports that he has been semi-retired since 1968 and keeps quite active. He teaches bridge classes and computer classes. Also, he writes custom computer programs and is active in the Bristol First Presbyterian Church.

Milt Salzman visited Cape Cod in July and stopped by for an hour. The reunion activities were discussed.

Deaths of two classmates must be reported. **Robert F. Needham** died at his home in Concord, Mass., on June 2, 1985. Bob was a former secretary of the Bunker Hill Monument Association from 1972-75 and was a life member and former vice-president of the Thoreau Society. He was former president of the Bay State Hospital League. Before retirement in 1969, he was an accountant and worked for the Sylvania Electric Co. in Woburn and the Concord Oil Co.

Bob was active with a wide number of historical organizations. Among them, he was former chairman of Concord's records and archives committee; and a member for life of Charlestown and Bostonian historical societies. He also belonged to the historical societies in Quincy, Arlington, and Hyde Park, as well as the Universalist and Massachusetts Historial commissions, the Concord Antiquarian Society, the Louisa May Alcott Memorial Association, the Massachusetts Bicentennial Commissions and the Concord Minute Men. He was a former officer of the Temperance League and the Unitarian-Universalist Society for Alcohol Education and he was a deacon at First Parish Church in Concord.

Bob was the co-author and author of two books on Unitarian history. He had been an annual speaker at the celebration held on Patriots Day at Concord's Old North Bridge. In Concord, he served five years as executive secretary to the Housing Authority and he was an election warden and Republican election official for 48 years in Arlington and Concord.

He leaves his wife, Lucile (Merrill) of Concord; a daughter, Marjorie Sampel of Liberty, Tex., two sisters, Alice L. Trohon of Phoenix, Ariz., and Adele M. Hicks of Chester, N.H.

George E. Mason passed away on May 12, 1985 at the Gardner Manor Nursing Home in Chesham, N.H. George served for 27 years in the U.S. Army and was discharged in 1962 as a lieutenant colonel. During World War II he served in the ordnance department where he was chief of the industrial division in St. Louis, Mo.

After his military career he worked as sales manager, director and vice-president of companies in Indiana and New Hampshire before retiring in 1976. He leaves two daughters, Marilyn LeStage of North Attleboro and Carol Geoffrey of Baldwinville; one brother, Robert P. Mason of Attleboro; and four grandchildren.

Belatedly word reaches us of the deaths of widows of two classmates. Mrs. **William S. Bishop** died in Westfield, N.J., on January 20, 1982, and Mrs. **John A. Carnagey** passed away in Baldwin, N.C., on October 7, 1983.—**F. Leroy (Doc) Foster,** Secretary, 434 Old Comers Rd., P.O. Box 331, North Chatham, MA 02650

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Due to the lack of space in the *Review*, my October classnotes had to be held over until this issue. There is much to report.

Here it is July 4th and I have just finished reading the July issue which contains a portrait of **Jim Killian** with tribal headdress of the Osage Tribal Nation into which he had been inducted on February 2, 1957, one of the myriad such occasions in 60 years of M.I.T. service. The same issue contains a review of Jim's recently published *The Education of a College President*. Fortunately having had considerable leisure time in the past few weeks I had been able to complete my first reading of the book. It is a fascinating autobiograhy of an extraordinary career and a detailed history of a critical period in M.I.T.'s development as well as the world in the last 60 years. This breadth of coverage of world affairs was made possible for Jim through the involvement of M.I.T. in the Radiation Laboratory work on radar in 1940 while Jim was serving as executive assistant to President Compton who was much preoccupied with his wartime work in Washington. At the same time **Stark Draper** was working on his developments of computing gunsights, and other government-related projects were being undertaken. The administration of these affairs as well as the day-to-day operation of the M.I.T. campus gave Jim wide experience as an executive and broad contacts with leaders in science and government

which prepared him for the assumption of the Presidency in 1948.

In August 1946, he had recommended the establishment of a committee, later known as the Lewis Committee, which was to study the long range educational objectives of M.I.T., and later led to the establishment of the School of Humanities and Social Sciences. A new elective undergraduate curriculum made up of one-half science and basic engineering and one-half humanities and social science. To quote: "Thus did the Lewis Committee emphasize the need to bridge the 'two cultures' gap . . . " and allow M.I.T. to move on from an engineering school of great merit to a university polarized around science. It is difficult to believe that one man could have had the number and variety of high level experiences in one lieftime as described in the 400 odd pages of this book. I am now in my second reading of it, reflecting on my own lifetime as the story unfolds. I am sure you, too, will be similarly fascinated with a sense of sharing a part of a full and fascinating life.

Mrs. Walter Smith, whose husband is of the class of 1928, participated in a recent telethon and contacted Mrs. **Juan E. Chaudrac** who told her how much she and her husband had enjoyed our most recent reunion and how much M.I.T. meant to both of them, but unfortunately her husband Juan was another victim of the dreaded Alzheimer's disease. . . . A brief note from **Alonzo Ruff** tells us that he has recently completed a history of the frozen food industry in Sweden to be published by Frigosantia of Sweden. . . . A letter from **Charlie McCulloch** is partially quoted: "**Jim Offutt** died on May 14, 1985 in Florida according to his daughter Sara. His last address was 8335-139th Lane N., Seminole, Fla. 33542. Jim had heart bypass surgery in May, 1982 and in August again underwent surgery to correct an aneurysm. Jim's first wife Alex died in 1979 and he married Mrs. Agnes Holley in November, 1982 in Clearwater. She survives him as do a son James living in Syracuse, N.Y.; and a daughter Sara living in London, England. Helen and I saw Jim and Agnes in Clearwater in December, 1983 when they entertained us at lunch. Since then we have kept in touch by telephone and correspondence and on several occasions Jim reported that he "was getting along quite well but would like more stamina." Chest patches controlled his angina but his daughter tells me that his energy level declined so much in recent months to the point where life was no longer tolerable, so the end came quite peacefully and with some relief." A letter to me from daughter Sara tells me that before Jim died he wrote an entry which he wished placed in the *Review* which we print herewith: "Jim Offutt, 81, Course X-B, died May 14, 1985. He was given the Morgan award in 1979 for over 25 years' service as M.I.T. Educational Counsellor in the Chicago area. He was a member of the M.I.T. Visiting Committee on Building Engineering and Construction from 1950-54. He was employed by the United States Gypsum Co. for over 40 years and retired as industrial marketing manager. During this time he developed industrial uses for gypsum and lime."

Through Alumni Association records the death of **Augustine J. Cotter** of Pine Grove Apartments, Searsport, ME 04974 was noted with no known survivors. . . . Mrs. Virginia B. Burch of 5010 White Flint Dr., Kensington, MD 20895 advises of the death in March of her father **Vincent B. Bennett** of 50 Argilla Rd., Ipswich, MA 01938. . . . The *Brockton Enterprise* published the death on April 20 of **Valentine Harrington** in Del Manor Nursing, Rockland, Mass., after a long illness. He had received his Ph.D. at M.I.T. and had been employed before his retirement at the Avco Corp. of Wilmington as a doctor of chemistry. He was a member of the Hanover school committee in the 50's and 60's serving on the building and planning committee and was instrumental in the construction of the high school. He also served on the South Shore Vocational Technical Regional School Committee or 20 years and again involved in the construction of their school. He is survived by his wife Lois B. (King), a son Steven K., two daughters Gwendolyn Moughalian of Hanover, and Linda Capilli of Forest, Va., and 11 grandchildren.

Eben Haskell, writing from a new address 23 Groveway, Clinton, CT 06413, mentions a family celebration of his 80th birthday to be celebrated August 10 with 39 members to be present. He expressed much the same views on Jim Killian's new book *The Education of a College President* as we have above, particularly commenting on the tribute to the old English and history department teachers and courses reducing his "intellectual parochialism" and stimulating a lifetime of interest and reading in historical biography and fiction, and in archeology.

We have been reporting in many previous issues of the *Review* the numerous gifts and other benefits contributed to various causes by **I. Austin Kelly**—now we have news through the **Hottentot,** publication of the M.I.T. chapter of the Dekes, of a donation by twin brother **E. "Bird" Kelly** which was employed for equipment purchases and renovations for a lounge-bleachers-bar on the first floor. Bird has promised several other $2,500 donations for future projects. Also, notice has been received of a donation to M.I.T. by **Hazel Edelman** in memory of **Bill Hoar** whose passing was noted previously.

A letter from Dr. Robert A. Joy advises that **Alfred P. Steensen** died on March 30, 1985 of myocardial infarction. We do not recall any previous notice of death of **Philip A. Hendee** who is listed in our alumni records at 102 Joseph St., Charleston, W.V. 25303. However, a letter to the President's office from a law firm states his death on September 25, 1984 and advises of a bequest of $5,000 to M.I.T. No other information is available and we should like to hear from any of his classmates with any further information.

A form for the preparation of biographical information has been sent to you with our urging that you fill it and return in the envelope provided. Unfortunately, we do not have accurate and complete addresses of surviving spouses of our deceased classmates. As we consider their biographies, even if brief, fully as important as those for us still living, an extra copy of the form was including in the mailing. If you do know the widow or other close relative or recent friend please ask that person to fill out the form and mail it to us. If more than one form is received we will arrange to consolidate them. Even better still, if you have been on familiar terms with the career and characteristics of a deceased classmate, fill it out yourself.—**William Meehan,** Secretary, 191 Dorest Rd., Waban, MA 02168

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John B. Drisko writes: "At long last, Denny and I have 'integrated' our two homes—a suburban home in N.J. and a seasonal rural home in Pennsylvania—into a single home on the fringe of Easton, Pa. Back in freshman math in 1923, I never realized what an involved process integration could be. Our 60th will be here before we know it, and I look forward to it and seeing you and Ruth." Good to hear from you, Johnny.

Charles H. Hurkamp of Hilton Head, S.C., has occupied his spare time in an unique avocation—the creating and printing a booklet of "Double Acrostic Puzzles." It certainly involved an immense amount of time and thought and the result is very provocative and amusing. Congratulations Charley—your VooDoo days were not for naught. I assume you will sell a copy to your classmates if they wrote to you at 1 Baynard Cove Rd., Hilton Head. He apologizes somewhat: "There's nothing special about it, except that I made it up and thus may have become the first of the Class of '27 to perpetrate such a deed. I guess we all have to go to pieces sometime."

President **Harold (Bud) Fisher** called a meeting of the class officers on August 20 and additional officers were elected: **Nathan Cohn,** vice-president and reunion chairman; **Ezra Stevens,** vice-president and treasurer and finance chairman of reunion; and **Harold Edgerton,** vice-president and chairman of reunion events. The reunion chairman then announced the following acceptances of other members: **Larry Day,** communications and registration; **Dick Hawkins,** arrangements; **Russ Westerhoff,** reunion gift chairman; and **Bud Fisher** and **Joe Burley,** ex officio.

After deliberation it was decided to hold our reunion on campus and reserve rooms at Hyatt Regency with McCormick House optional. The dates were set for Tuesday-Friday June 2-5, 1987. As a welcoming function, it was approved to again have cocktails and dinner at the M.I.T. Museum which was enjoyed at our 55th. Letters will be sent to the class periodically giving further plans. Anyone wishing to express suggestions or preferences may write to **Lawrence Day,** M.I.T. Alumni Office, Cambridge, MA 02139.

We all appreciate Nate's enthusiasm to instigate an enjoyable and successful reunion.—**Joseph C. Burley,** Secretary, RFD #3 Epping, NH 03042; Assistant Secretaries: **Lawrence B. Grew,** 21 Yowago Ave., Branford, CT 06405; and **Prentis I. Cole,** 2150 Webster St., Palo Alto, CA 94301

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We are now at the halfway point between reunions and already it is time to be looking ahead. We are delighted to report that Ruth and **Abe Woolf** will chair the 60th reunion. So, start planning now and think positively!

Following retirement, many of our classmates moved to warmer climes either permanently or as a seasonal escape from winter. However, at least seven chose to head in the other direction and now live the year around in the northern state of Maine. Recently we talked with two of them. **David Haynes,** during his professional years, was in the petroleum industry serving Tide Water Oil Co. and Getty Oil Co. Now he lives in York Beach, Maine, where his retirement interests have been largely related to the sea. Only recently has he given up his lobstering activities. Prior to this, he operated five to ten traps—just enough to supply his family. He still enjoys fishing and spoke of catching 26 ten-pound bluefish just off his dock in only five feet of water. Considering the age factor, Dave says he is still doing OK and gets about in good fashion. Sadly, he lost his wife, Esther, after 54 years of happy life together. Marjorie and **Bill Bendz** are Maine residents—and with emphasis since they have two homes in that state. When living in California they had to cross the continent both ways every time they wanted to enjoy their summer home in Boothbay Harbor, Maine. This problem was solved by moving to Cumberland Foreside, Maine, only about an hour's drive from the summer place. Over the years, one of Bill's interests has been in clocks and the repairing of clocks. While the clock industry has been profoundly changed by the introduction of electronics and especially quartz controlled movements, he has moved with the times and now works with all kinds. At our three-day Tenth Reunion at Ye Castle Inn, Saybrook, Conn. (June 3-5, 1938), Bill quickly discovered that the block clock in the Castle tower had been inoperative for many months. This was a challenge! So, Bill with the assistance of your secretary, undertook to repair the big mechanism. We climbed into the tower and, after an afternoon of dirty, greasy work, had the thing running beautifully. However, we won no friends. The clock bells banged away fiercely day and night for the rest of our stay, thus denying sleep and rest to all. While we were talking with Bill he mentioned that Ellen and **Dean Batchelder** would be celebrating their 50th wedding anniversary at a party on September 28, 1985 given by their daughters, Linda and Gay. To Ellen and Dean, hearty congratulations!—**Walter Smith,** Secretary, 37 Dix St., Winchester, MA 01890

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Due to the lack of space in the *Review*, my October class notes had to be held over until this issue. There is much to report.

Milton Male of Pompano Beach, Fla. writes, "After a brief surgical experience in March, I am fully recovered and able to get around. I had my 80th birthday last week, and my wife Maxine and I celebrated same along with our 53rd wedding anniversary. We'll be taking a cruise in a few weeks to commemorate our happy events. We enjoy living here, particularly since my son and his family are less than an hour's ride away. It has been quite a while since we have been up north. Maybe we'll make it to our 60th in 1988. Regards to all our classmates." . . . **J. Wesley Walters** of St. Paul, Minn. writes, "Last June was a busy month for us—first Father's Day, followed by my 80th birthday, another milestone, followed by a celebration of our 56th wedding anniversary and capped with our daughter's birthday." The Walters have two children, six grandchildren, and four great-grandchildren. . . . **John G. "Jack" Sullivan** of East Dennis, Mass. writes, "Retirement living can be amazingly busy. I am still doing volunteer work at the Cape Cod Hospital, now in my 13th year. My wife Lucille and I both had some health problems last year, but we are back in good health. Recently we took a great trip to Central America—perfect weather and no hostage incidents. We enjoyed it immensely."

Jonathan F. McCray of Heber Springs, Ark. writes, "Isabel and I are both well, though I learned from a recent examination that I am growing cataracts. Isabel announced recently that our house is too big for our current needs and she is unable to take care of it. We placed it on the market. Best wishes to all." . . . **Frederic D. Merrill, Jr.**, of Chatham, N.J. has had Parkinson's disease for some time, but he is able to get around. Recently, he and his wife Carmen went to Cape May to visit their daugther, her family, and two grandsons. They have another daugther who lives in Tucson, Ariz. with her husband. He sends his regards and best wishes to all. . . . **Nathan E. Promisel** of Silver Spring, Md. writes, "Evelyn and I have been doing some traveling, partly business and partly vacation. No earth shaking changes in my lifestyle, I am still doing consulting for industry and the federal government. I also specialize in lectures for professional societies and other advisory and planning committees, so that the months pass like weeks. After 50 years, I suspect technology is in one's blood to stay. May the Force at M.I.T. be strong." Nathan has had a distinguished career in materials science and engineering. Aside from B.S. and M.S. degrees from M.I.T., he did his doctorate at Yale and received an honorary doctor of engineering degree at Michigan Technological University. He was assistant lab director at International Silver Co., leaving in 1940 to become chief scientist and engineer (aeronautics and weapons) and materials research coordinator for the Department of the Navy, until 1966. Presently, he is an international consultant. He has been a long-time member of the National Materials Advisory Board of the National Academies of Science and Eningeering, being its executive director from 1966 to 1974. He was also a member of the Office of Technology Assessment (Congress) Materials Advisory Committee, as well as chairman or member of numerous government and public technical groups. The Promisels have two children and five grandchildren. His hobbies are travel, photography, chess, and gourmet *eating*.

Richard E. Bolton of Westmount, Quebec, Canada, writes, "I found the personal experience of meeting so many classmates at the 55th, a most wonderful extension of life. Most of us have spent our lives with our families and our professions to the exclusion of those broader experiences which so much enrich our existance. Your devotion to maintaining a personal relationship with the Class of '29 is a wonderful achievement. Thanks to your efforts, I have benefited more than you can imagine and I am very grateful to you. Life goes on much as before, I have a few private consulting jobs, some useful financially, others labors of love. Sometime in May, I plan to visit the United Kingdom and see some of my cousins once again after an absence of eight years. We are a closely knit family and have been for generations. My cousin Jack married a Winchester, Mass. girl who is now a widow living in Weybridge, Surrey. I was an usher at their wedding and must see her again before it is too late. I am also considering a short trip to Stockholm to walk the streets and remember the wonderful times I had there in 1929. I was invited to the reception for Thomas Mann, who was about to receive the Nobel Prize for literature. My host was Sidney Gibson, artist, architect, and furniture designer, who introduced me to Gunnar Asplund and to Prince Eugene Bernadotte, painter and art connoisseur. It was a wonderful world which is now gone, real achievement accompanied by great elegance, tail coats, silk hats, etc., totally irrevelant but nice to look back on. I have not been back for 30 years but would like to see Stockholm once more."

Hunter Rouse of Sun City, Ariz., writes, "Your birthday greetings with a personal note are as welcome as ever. Recently, we had a nice visit from **Wes Walters** and his wife Josephine. It seems that St. Paul winters are so severe that it sends many of its retirees to the sun belt each year. . . . **Chung-Foy Yee** of Canton, P.R.., China, writes: "I am still enjoying fairly good health and continue holding my present position as professor at the South China Institute of Technology. Sorry I could not make our 55th reunion, but will try to attend our 60th. Greetings to all my classmates." His hobbies include morning exercise for aged people and hiking in the morning half to one hour daily.

Received a note from **Romeo H. Guest** of West End, N.C. "I spend lots time in my country place and a lake near Pinehurst, N.C., with primative antique tools and farm furniture. I enjoy going to estate auctions to pick-up items and add to my collection. Moore county is a fertile area as retirees pass on their antique collections to younger fellows such as this 70 year old friend named Romeo Guest." . . . **Seymour A. Baum** of Jupiter, Fla., writes, "Both my wife Claire and I are enjoying best of health for which we are truly blest by the Lord. We continue our golf routine and also come and go as we please now that we have one residence to contend with. We will be taking off for our old stamping ground early August which will take most of the month. In September, we will be revisiting our homestead in Hot Springs, Va., to play golf and also have a glimpse of the fall beauty and colors in the mountain. Best wishes to all."

John Happel of Hastings-on-Hudson, N.Y., writes, "For our winter vacation this year we went to Guadeloupe in the French West Indies. It has fine beaches and a park with a tropical rain forest. We expect to go to Lake Placid this summer as usual, though both ends of our stay will be trimmed a bit. Late in June I am going to give a paper in York, Okla., with a French colleague with whom I have been doing research. And late August, I am chairing a session of the American Institute of Chemical Engineering in Seattle, Wash. I have never been there and I hear that the scenery is magnificent. The most exciting thing that I did this year was to visit my daughter Ruth in Sierra Leone, W. Africa. She is studing monkeys there for her doctorate in anthropology at Harvard. I returned with her to New York with 17 pieces of luggage containing fruit and plant specimens that constitute the diet of a number of species living in the forest there."

I regret to announce the death of the following members of our class: **Marshall H. Fay** of Port Washington, N.Y., on February 8, 1985; **Warren W. Walker** of Montclaire, N.J., on April 20, 1985; **Harold C. Pease** of Saint Petersburg, Fla., on May 30, 1985; **Henry S. Muller** of Belmont, Ohio on March 26, 1985; and **Howard G. Pankratz** of Riverside, Calif. on July 19, 1985.

I received a letter from Elise Walker, announcing her husband's passing, reading, "I am sending the enclosed with a heavy heart. Warren was a loyal alumnus of M.I.T., a loving father and my wonderful and loving husband of 48 years. He was blessed with four children, ten grandchildren, success in business and respect from business and community leaders and friends. He will be missed by all of us but he had a peaceful death in his own home after several years of failing health."

Warren had many close friends including your secretary among our classmates who will miss him. He had a brilliant career. He left Weston Instrument Corp. as production manager to join the Graphite Metallizing Corp. in 1944 and served as its president for the past 40 years. He was director of the Yonkers General Hospital, a director of the Yonkers Chamber of Commerce and a former president of the Yonkers City Club. He was recently honored by the Hudson River Fisherman's Association, an environmental organization, for his concern with industrial pollution. In 1976, he was chosen as "Man of the Year" by the Yonkers City Club. Warren was a past president of Montclair Society of Engineers and a former member of the Montclair Planning Board. As a member of the Presby Memorial Iris Garden Citizens Committee, he was instrumental in the preservation of the Presby Memorial Iris gardens in Mountainside Park and the purchase of the Walther House adjacent to the gardens, both of which are now registered National Historic Monuments. He was elected a sustaining fellow of the M.I.T. Corporation. A past chairman of the National Electrical Manufacturing Association (carbon section) and a member of the tax committee of the National Association of Manufacturers. He is listed in Who's Who of the East, Who's Who of Engineering and is an honorary member of several engineering societies. Until his death, he was the executive director of the American Association of Industrial Management and a former president of the N.Y.-N.J. Chapter of the National Metal Trades Association, predecessor to A.A.I.M.

I received a letter dated June 11, 1985 from John C. Pease, "I am writing this note to inform you that my father, **Harold C. Pease** passed away unexpectedly on May 30, 1985 at his home in St. Petersburg, Fla. I noticed in the May/June issue of the *Technology Review* that you had seen my father a few years ago at the M.I.T. Florida Festival in Cypress Gardens. As you may know, he was a strong supporter of M.I.T., being a member of the Class of 1929. When his health was better, he enjoyed attending Class and M.I.T. affairs, and he told me that he had a nice time at the Florida Festival and met a number of friends that he hadn't seen for quite a while. My father worked for the Factory Mutual Insurance Co. as a fire protection engineer for 35 years before retiring and moving from Ridgewood, N.J., to St. Petersburg in 1977. During his retirement years, he enjoyed being in a warm climate and persued his lifelong hobby of model railroading. The only time he liked to visit us up North was in the summer where there was no chance of snow. In addition to myself and my wife, my father is survived by two grandchildren, both in college presently, one attending Colorado School of Mines, and the other is at Cornell University." Harold was a member of Course XVII along with your secretary, **Robert S. Pride** of N. Palm Beach and **Leonard C. Peskin** of Wyncote, Penn. We were the first graduating class of the course, now part of Course I.

Joan Crothers of Lexington, Mass., **Howard Pankratz**'s daugther, reports that Howard died in his sleep. He had been living at Cypress Gardens Convalescent Center in Riverside. When he and his wife Margaret moved to California from Ohio in 1963, Howard "discovered himself in a land without attics and basements, where even a workshop was something exotic. Margaret surrounded their corner of desert with orchid plants,

camellias, lovely trees, and shrubs. Howard wanted adventure in whatever he did and sometimes went looking for it." Survivors include his beloved wife, Margaret Hone (they were married at the Boston Trinity Church in December 1927), two daugthers, and six grandchildren. Howard was a close friend of your secretary, being in the same course (XVII) along with **Robert Pride, Len Peskin,** and **Harold Pease**. Howard and Margaret got married while undergraduates, one of the most handsome couples on the campus. They came east in the early 1950s and paid us a visit in our Arlington home "wining and dining" with champaign, recording the event in movies which have been incorporated with M.I.T. reunion activities and shown at a number of reunions. Howard has a host of friends all over the country with whom he kept in touch by phone.—**Karnig S. Dinjian,** Secretary, P.O. Box 83, Arlington, MA 02174

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On rare occasions over the past 25 years I have "discovered" a classmate who was unaccountably missing from the 705 index cards that the Alumni Office sent me in 1960, and of whose existence I was previously unaware. The most recent such "discovery" is **James Torbit,** course VI-A, who graduated with us in 1930 and thereafter received an S.M degree. This will be his first appearance in the Notes. Jim's working career was spent as an electrical engineer at General Electric's Philadelphia plant. At the time of his retirement in 1968 he was manager of engineering for medium voltage switch gear. Thereafter he did a certain amount of consulting work, "but none recently." Jim and his wife Florence now live in a homeowners association called Palm Beach Leisureville comprising 1,800 houses and 500 apartments in Boynton Beach. Fla. Jim has been a member of the Leisureville board of directors since 1981 and president since 1982. He says there is an active M.I.T. Alumni Association in Boynton Beach, of which he was secretary-treasurer for three years. The Torbits have two daugthers and three grandchildren.

We have at hand a letter from **Reg Bisson** whose manifold retirement activities have previously been recorded in the Notes. New items mentioned in his letter are his co-authorship of the 150th anniversary booklet of the Laconia, N.H. Savings Bank, of which he is a trustee, his acquisition of a "very active 20-month-old grandson," and the fact that he and Adrienne will celebrate their 50th wedding anniversary next year. . . . In **Max Wheildon**'s recent report we learn that Max is still interested in his three "s" activities: shooting, sailing, and skiing, although he does little skiing now. He has a life membership and certified instructor ratings in the National Rifle Association in five areas to support the junior activities program at the Southboro Rod and Gun Club. His sailing activities include acting as navigator on a 142-ft. schooner and sailing in Boothbay Harbor where the Wheildons have a summer home on Sawyer's Island. Max also spends considerable time at "Brae Maple Farm" in Union, Maine, where his daughter raises Scotch Highland cattle. . . . **Frederick Trescott** is a retiree of Bethlehem Steel Co., Shipbuilding Division and of Stone & Webster as well as a former employee of General Dynamics Corp., Quincy Yard. He and his wife Laura now live in Marshfield, Mass. He says: "I now weigh twice as much as when I was coxswain of a class crew. If I got into an eight-oared shell now, it would sink stern first." Join the Club, Fred; I am now 60 pounds more than I did upon arrival at M.I.T.

Notices have come in concerning the deaths of two more of our classmates. Mary Guinan has written that her brother, our classmate **John Guinan,** died in Arlington, Mass. on May 18, 1985. Since I did not have anything about John in my files, I asked Mary for some information about him, which she has kindly supplied. It appears that after graduating in Course I, John started his career with Brooklyn Edison, which shortly thereafter became part of Con Edison of New York. He was primarily involved in design and construction of power facilities, and when the war curtailed such work he went on leave for several years. During that time he worked for Dravo Corp., Shipbuilding Div., who produced most of the LST's. He also spent a year or so with the M.I.T. Radiation Lab in the Component Engineering Group. At the end of the war he returned to Con Ed until he retired in 1969, at which time he returned to the family home in Arlington, Mass. John never married, and his primary nonbusiness interests were hiking and climbing with the Appalachian Mountain Club and the Fresh Air Club of N.Y., as well as railroads—real ones and model trains. As far as I know, Mary is his only survivor.

Bertwell Whitten, died in Belfast, Maine, on June 5, 1985, only six weeks after he sent me an information form on the basis of which I prepared an item for the August issue. At that time he reported that he was slowly recovering from a heart problem, which apparently recurred. Bert worked as a construction planning engineer for Boston Gas Co. for many years and retired in 1966. After his retirement he and his wife Phyllis spent winters in West Roxbury, Mass., and summers in Searsport, Maine, where they owned several houses that they rented. During the summer Bert kept busy making minor repairs on the rented houses and doing some gardening and photography. In addition to his wife, Bert is survived by a son Bertwell E. Whitten who is head of the biology department at Michigan Technical University in Houghton, Mich.; a daughter Jane, who teaches remedial reading in Milford, Mass., and three grandchildren.—**Gordon K. Lister,** Secretary, 294-B Heritage Village, Southbury, CT 06488.

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Unfortunately, very little news has been received from our classmates for publication this month. A very welcome phone call recently from **Randy Binner** the other day asking about my health in the light of my recent illness is about the only news to report. Thank goodness all is well with Randy and Hope as well as their family. Fortunately, no deaths have been reported this month.—**Edwin S. Worden,** Secretary, P.O. Box 1241, Mt. Dora, FL 32757; Assistant Secretaries: **John Swanton,** 27 George St., Newton, MA 02158; and **Ben Steverman,** 2 Pawtucket Rd., Plymouth, MA 02380

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Arthur Marshall has a many-faceted career. The Springfield Orchestra Association chose to comment on the following aspects: "Springfield attorney Arthur Marshall is active in at least ten community organizations in the greater Springfield area. Music has always been an important part of Arthur Marshall's life. As a musician, he enjoyed success with 'Art Marshall and His Orchestra.' As an attorney and a community leader, he has been a member of the board of directors of the Springfield Orchestra Association. As part of the Association's 40th anniversary, Arthur Marshall was made an honorary director of the Association in recognition of his long-term commitment of service and support of the Springfield Orchestra Association. Mr. Marshall's most recent conducting stint included an appearance with the Orchestra during the 1984 Springfield Symphony Pops at Stanley Park."

W. Stewart Roberts says he is "approaching retirement—now down to 25 percent active level." He is busy investigating turbine failures.

I must now tell you of many of our classmates who have recently died. It is particularly sad because I knew a few personally. I found they lived useful and interesting lives.

Anthony Savina gives me the news that **John Osterman** died in July 1985. He was a retired assistant vice-president for AT&T. During the war he was an army lieutenant colonel. He was active in many civic organizations. He is survived by his wife Helen. . . . **John Brown** informs me that **Neil MacLaren** died in June 1985. Before his retirement in 1970 he was New England sales representative for the American Machine and Foundry Co. He was active in church and civic affairs. He leaves his wife Doris. . . . **Earl F. Anderton** died November 27, 1984 while vacationing with his wife Sally in Zurich, Switzerland. He worked for many years with Scott Paper Co. In 1976 he was president of Ekono, Inc., a Finnish consulting engineering firm. He served in the navy during World War II. He and his wife had celebrated their 50th anniversary on September 2, 1983.

Dr. **Samuel E. Paul** died May 4, 1985 in Napa, Calif., after a lengthy illness. He was a general practitioner in Troy, N.H., for 29 years. There he made a deep impact in the community because he was so active in so many ways: medicine, civic and fraternal organizations, as an editor, and his interest in boating. In 1969 he moved to California where he worked as a psychiatrist and a professor. In 1977 he married Margaret Hanold and he retired in 1982. Dr. Paul is survived by his wife, three sons, and three grandchildren. . . . **Lawrence Grady** died unexpectedly on June 4, 1985. He worked in private industry for many years before joining the Small Business Administration in 1960. He helped found the Service Corps of Retired Executives. He retired in 1970. Besides being an avid golfer, he was involved in many civic pursuits—including the Nuvoice Club, a club for cancer victims learning to speak again after losing their voices due to larynx operations. He leaves his wife Janet, two daughters, and a grand daughter. . . . **E.B. Powell, Jr.,** died in June 1985 after a long illness. He was an ordnance proof officer during World War II and then he eventually became vice-president of Waterbury Buckle Co. He leaves his wife Eleanor, a son, and two grandchildren.

Underway is our memorial fund to M.I.T. in honor of **Ed "Bunny" Nealand**—our one time class president and many times chairman of reunions. Solicitations were made only to members of the class who had worked with Ed. If less than $1,000 is raised, then the class treasury will make a contribution.—**Melvin Castleman,** Secretary, 163 Beach Bluff Ave., Swampscott, MA 01907

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Here it is almost Christmas time and these notes were sent to Cambridge in August! We have just had our vacation and much mail came while we were away. Keep up the good work, fellows!

The **Mal Mayers** have been back to China; quite our world travelers, aren't they? . . . **Jim Norcross** writes that his business of advising and helping homeowners with their residential problems is booming down Philadelphia way. He writes recommendations for saving energy, will specify and supervise home changes, and says that Professor Tucker who headed the construction department told him this would be a good field. It has been.

Bill Pleasants wrote that **Dick Morse** is a good friend: he arranged for him to sit with President Gray at lunch and with Howard Johnson at the Pops Concert. Does anyone look at the TV show "Cheers" and the scene of the old Fensgate Hotel on Beacon St.? Bill asks. He says he rowed for Emery Clark when they were on the sophomore crew. He was involved as an expert witness in a large and serious industrial accident case. Foster Wheeler was pleased with what Bill could do for them. Bill and Helen were in Switzerland and Germany this summer. They winter in Dunnedin, Fla., where he has been treasurer and dinner arranger for the M.I.T. club.

We have two notices of deaths from the

Alumni Office: Captain **John Smyth,** who was living in Peekskill, N.Y., and **William Murphy**.

Postcards have come from **Ernesto DeSola** in Guatemala showing an example of the new buildings there and reports that the summer temperature is between 55 and 66 degrees and the altitude 5,000 feet. . . . **Fred Murphy** and Anne have been to Bermuda, and **Dick Fossett** and Charlee were hicking in the Swiss Alps at midsummer's report.

A long letter from **John Longley** reports **Charles Cashman, Leonard Julian,** and **Ed Simpson** were at Technology Day, 1985. His wife, Lil, gave a family visitor a haircut in the Longley kitchen when he came for the wedding of their neighbors. . . . **Neil Hopkins** gave a vocal recital in June; it was quite a full program, including classical as well as popular music.

Steve Rhodes writes from Taunton, Mass., that **Dayton Clewell** hasn't dropped off the face of the earth. In June, Dayton spoke to Steve's Rotary Club when **Fred Murphy** and **Dick Hodgdon** were guests. **George Stoll** couldn't attend as he was in Maine presumably working. Dayt ran a practice session of his China talk before the Kiwanis in Darien before tackling Steve's club.

Bill Harper sends a capsule account of the last 50 years. He uses classy brown stationary saying that he is a reseacher. After graduation he lived in San Antonio, and worked with the War Production Board, then moved to Seabrook, Tex., and now lives in Hattiesburg, Miss., on a 20-acre farm that is all paid for! He sang with the M.I.T. Glee Club and later founded the chanters club for the two shrine groups. He recalls that **Warren Henderson** was also a glee clubber. Now his major worry concerns taxes. Give it up, boy, you can't help it a bit.

Robert Wellwood, in response to a request for personal information sent a resume dated December 27, 1965. He is a man who won't tolerate ditto marks in his history. As a mechanical engineer he worked for all kinds of folks—mostly in connection with the railway business.

If you need any addresses to send Christmas cards, drop me a note with information about yourself and I'll answer. Have a happy holiday season.—**Beaumert Whitton,** Secretary, Cottage 112, Sharon Towers, 5150 Sharon Rd., Charlotte, N.C. 28207

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Preparing these notes has not been a very happy task this time; there is a surge of news about losses, including one that will be distressing to any of you who were active in rowing or in class affairs around Boston.

Taking them in the chronological order of their deaths, **Herbert A. Morriss, Jr.,** died on February 9 in Manhattan Beach, Calif. In last year's *Alumni Register* he was listed as a project engineer with the Aerospace Corp. in El Segundo. A touching aspect of this loss is that it came from his wife, Mary, in a note on an Alumni Fund solicitation. In returning it with a contribution she wrote, "M.I.T. is where 'our' life began. May this help give it continuity."

Charles H. MacFarland III passed away on June 13 in Stafford Springs, Conn. His wife **Ruth** was also a member of the class, being a graduate of Course XIII. Here is another reminder of how, for so many of us, our years at M.I.T. provided not only an education but a life partner as well.

Gerald Reed, Jr. died in Quincy on July 5 following a short illness. This may be a familiar name to any of you who have had interests in sailing at M.I.T. Gerry had started in architecture, but things being what they were in those days, left in 1932 and spent two years at sea as a cadet in the U.S. Merchant Marine. He returned to M.I.T. in 1936 to the Sailing Pavillion where he spent the next 40 years as instructor and sailing master. He is survived by his widow Helen, a son Theodore in Washington, D.C.; and five grandchildren and two great-grandchildren.

The last one will be a shocker to any members of the crew. Through **Ray Jewett,** I got word from **Larry Stein** that **Johnny Westfall** suffered a heart attack on August 5 while visiting friends in Damariscotta, Maine. He was rushed to the hospital but was gone before the ambulance got there. John was a faithful "reunioner," a lot of fun to be with, and we will miss him in the future. He is survived by his widow Ruth.

I hope the families of those we have lost can draw some comfort and support from the knowledge that they have the sympathy of all the class.

Moving to happier things, I have a news release concerning the election of **Henry Regnery** to the National Board of Trustees of Boys Clubs of America. Henry lives in Chicago and is chairman of the board of Regnery-Gateway in that city. He is also chairman of the board of Joanna Western Mills. In looking back at the 25th reunion book I find that this company is a family textile business which Henry joined in the 1940s. In that same write-up is mentioned a book publishing firm he started in 1948 and which included William F. Buckley and Russell Kirk among its authors. I wonder if that activity is still continuing?

In more recent years Henry has been active in civic affairs in Chicago. He was for many years a member of the board of directors of the Chicago Boys Club (obviously, this led to his present selection by the national organization) and he is chairman of the American Conservatory in Chicago.

The October notes carried the story of **Norm Krim**'s vist with **Wing Lem Wu** in Beijing while the Krims were on a Chinese tour. Unfortunately, a few days later after this material had gone off to Cambridge I received a letter from **Hank Backenstoss**; he had also seen Wing in China and this was intended to be consolidated with Norm's information. However, because it has some interesting (and sentimental) additions I think they are worth passing on.

Hank's visit was a little different from Norm's since he was in China with a group of 25 power system engineers on a technical exchange program sponsored by the Chinese government. Prior to leaving this country Hank had learned that Wing's copy of the 1934 *Technique* had been lost during the Cultural Revolution. He contacted the Alumni Association and in just a couple of days they performed a minor miracle and Hank had a copy to take with him.

Wing joined the group for dinner in Beijing—they knew some presentation was in the wind, but had no idea what. To go on with Hank's words—"Towards the end of our 20 course (yes!) dinner, a baritone in the group led us in 'Auld Lang Syne' addressed to Wing, a serenade he greatly appreciated. I then presented the *Technique* to Wing, noting to my colleagues that it was 50 years since our graduation and an equal time since we had last seen each other. Wing, of course, was astoundend to have this prized M.I.T. momento restored to him. He responded with appropriate remarks and told us a little about the present open attitude in the Peoples Republic. The episode was brought to a conclusion with the group singing 'For He's a Jolly Good Fellow.' All in all, it was an occasion to be remembered."

Hank added a few notes on Wing's activities during the Cultural Revolution. He, and others from his Beijing Institute, were assigned to build refrigerated freight cars (a fine example of what can happen when dogma supersedes intelligence in making judgments). He would get up at 4 a.m. on Mondays and cycle two hours to be at work by 7 a.m. He apparently stayed close to where he was working because it wasn't until Saturday that he could make the return trip. It was rigorous, but he chuckled and said "he was younger then!" At the present time his aerodynamic skills are in demand dealing with wind forces on high-rise buildings—there are already a number of these completed in Beijing and many more under construction. Hank wound up his letter by offering to give some more comments later, if I wished, about his China trip. Silly man, of course I do—and I'll put the arm on him in Williamsburg at the mini-reunion.

I hope you readers will not feel that I've gone overboard recently with material about Wing. I think it is great to hear about, and appreciate, the bond that was created 50 years ago when a young man came to M.I.T. and then returned to what proved to be virtual isolation from us in his original homeland; and still survive the intervening years of adversity.

Please note that for change there is nothing about my travels. (There haven't been any since my trip to eastern Europe.) Between the mini-reunion in early September and some other plans for September and October I have a strong suspicion that the next notes will be coming from **George Bull.—Robert M. Franklin,** Secretary, P.O. Box 1147 (620 Satucket Rd.), Brewster, MA 02631; **George G. Bull,** Assistant Secretary, 4601 N. Park Ave., Apt. 711, Chevy Chase, MD 20815

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Here are the last batch of pre-reunion news, notes, and letters. **Robert G. Clarke** advises through the Alumni Fund Office: "Unable to attend 50th reunion because of recent case of phlebitis." . . . **Alfred L. Greenlaw** writes: "Still working on reduction of jet engine noise. Recently granted patents in the U.S. and England on short ejector type device. Studying history and archaeology in relation to Biblical dating. Drs. Velikousky and Courville have made very interesting contributions relative to the accuracy of Scripture." . . . **Franklin F. Lovering** writes: "Nursing a gimpy left knee and entertaining son and two grandsons from Ashland, Ore. Also keeping two grandchildren from Eldorado, Ark., while my daughter and husband go to Lake City, Colo. Wish I could dig some clams in all this West Texas sand—no water though!" . . . **Copeland C. MacAllister** sends this note: "After 15 years researching the circus in New England prior to 1875, I have published my first book *Uncle Gus and the Circus*, the story of a man from Acton, Mass., who was a big man in the New England circus from 1850 to 1871. The book contains much early circus history not available elsewhere."

Here's a letter from **Chet Bond** in Florida detailing some of his earlier activities: "Flew into Washington to attend a funeral of my brother-in-law, Bill Murphy, '33, Army Engineer Retired Colonel. We married the Murdock sisters of Somerville. He died suddenly at the wheel of his car near Sarasota in May. Kay and I were divorced in April so its back to widowerhood for me. Last year this time I spent a week in Scottish Highlands then on the St. Andrews playing the Old Course, from there on to Egypt all the way up the Nile to Aswan Dam, then over the Mediterranean to Jordan and Lebanon and Greece for ten days including a visit to Istanbul before returning to Paris and home. This year I just returned from 2,500 mile trip to National parks plus Mexico City. I feel fine and swim every day and play some golf. Two of my children, Chris and Tony, are unmarried; Rosemary was married to Bill Walker in Swampscott on June 22."

Now to post-reunion mail. Here's the letter from **Frank Hatch** which I promised in the last notes: "Your letter arrived while my wife was in the hospital for a new knee. She went in May 16 and came home June 7. She's recovering very well but is much restricted in getting around. Originally I had hoped to come to the reunion, but as time came closer I knew I could not make it. I even sent for the red jacket and grey slacks which I can now wear to the Stanford 50th reunion June 27-30. I am sending you the M.I.T. emblem patch which came with the red jacket. I thought that you could award it to one of the prize winners in our golf tournament, or do what ever else comes to mind. Judging from your latest in the *Review* there was a pretty good turnout, many '35ers whom I remember—I only could

have hoped that they would remember me. I note **Eugene Schwarzenbek** was going to be on hand. He and I went to the same grammar school in Nutley, N.J. I see that **Jack Ballard** lives in Oregon—on the seacoast. I would have liked to see him as we lived next door to each other on Beacon St. and were in many of the same classes. The same goes for **Bill Cross**. I am looking forward to as much golf as soon as I can get it in. As far as my score and handicap go, however, I am uncoordinated. I didn't start to play until about ten years ago and can't seem to improve as fast as I would like. Can't blame it on my health, though, which fortunately has been very good indeed. As far as other activities go, I am secretary of the Rotary Club of San Mateo. I also make wine from grapes I pick in the Napa Valley—Cabernet Sauvignon, White Riesling, Chenin Blanc and Chardonnay. The Chardonnay is the most difficult, and I can understand why it is usually the most expensive white. We crush and press the grapes in the back yard, do the fermenting in the garage, and store the cases under the house, in the crawl space where I go on hands and knees wearing a hard hat and knee pads."

Stocky Stockmayer wrote: "What a superb reunion we had! Those of us who were lucky enough to row in the crew were especially favored. My everlasting thanks to you for letting an illegitimate oarsman sit in amongst the rest of you. I'm looking forward to seeing the photos showing seven properly red-clad rowers plus a red-clad cox plus one dark blue Oxford bleep! Anyhow, the outing seemed to go well and you were properly merciful to us all. As to the rest of the reunion, in both places, I thought it was relaxed, altogether friendly and warm—just right in every way. I'm only sorry for those who missed it. I had written to urge the following (or phoned them) but got no results: **Dave Buckwalter, Fred Lincoln, Bob Scribner, Perk Ehrlich,** and **Howard Mason**. Our class's great cohesion during the past 20 years is very largely due to you and your Class Notes. The golf is a bit of icing on the cake, but for us non-white ball-chasers it's the column that does it, and we are eternally grateful. . . . Sylvia joins in the best regards. Ever feel like relaxing up in Norwich, Vt.? Would love to see you!" Although this letter is rather personal, I wanted you to see it because it is a reflection of the man we elected as our class president our last two years at M.I.T. Everyone needs to receive this kind of letter at least once in his life and for me it has come at a time when I had begun to wonder if any good positive things would ever happen again. This broke the ice for me I am glad to report.

Now for some notes gathered at the reunion: **Walter P. Green, Jr.**'s mother lived to the ripe age of 99 years and 8 months and died January 4, 1985. His father was in the M.I.T. Class of 1912 and they were married 65 years. Walter received his doctorate in 1940. . . . **Hank Ogorzaly** had twin grandsons born to daughter Lisa on April 28 bringing the score to five boys and five girls among his and Jewell's grandchildren. My own granchildren score reached 0 boys and five girls when my daughter Pamela had twin daughters last March 1. This sets up some pressure on my son Peter who was married June 29, in New York City to the lovely Maria Consolazio to keep the Mowatt name going!

Those of you who were not at reunion, and especially those of you who sent in your biographies, will be glad to know the Class has a supply of Reunion Biography Booklets which can be purchased for $20 each. The Booklets have been made every more appealing by including full page photographs of our Class graduation picture and our Senior Class Dinner at the University Club plus our 25th reunion photo taken on the Walker steps. Many of you have already sent in requests which are being taken care of with shipments direct from M.I.T. For a set (there are two books), write to **Phoenix N. Dangel,** co-editor of the books, 329 Park St., West Roxbury, MA 02132 and enclose a $20 check made out to "M.I.T. Class of 1935."

Reports of the following deaths have come mostly from the Alumni Fund: **Alfred Z. Boyajian** early in 1985; **O. Leonard Colavecchio** died April 2, 1985; **Willard R. Crout** died in October, 1983; **Alex G. Keiller** died early in 1985; **Alwin R. Knoeppel** died in April, 1984; Captain **Robert T. Sutherland, Jr.** died May 31, 1985; and **Lincoln P. Vennard** died last November, 1984. Please write to me if you have or want more information about any of the above. In the meantime I shall be sending our regrets to surviving family members. I have the records of 98 class members who have died since our 40th reunion. '35ers hang in there, keep well, relaxed, and happy. And get off that letter to me you never had time to write.—**Allan Q. Mowatt,** Secretary, P.O. Box 524, Waltham, MA 02254

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With our Fiftieth reunion fast approaching I want you to know that I have been gratified by the response to the first mailing and by the time you read this you should have received more details with information on registering and ordering a blazer. Next time I will list those who hope to attend. If you have not returned the biographical questionaire I hope you will do so promptly, or request another form, if you have mislaid yours or, as some have done, messed it up. There are extras available!

I regret to have to inform you of the deaths of two classmates: **John T. Smith** died last June 7 in Bermuda where he was president of the English Sport Shop, Ltd. He was born in Milford, N.H., and served during World War II in Bermuda. He achieved the rank of lieutenant colonel in the U.S. Army. He was predeceased by his wife and is survived by two daugthers and six grandchildren. . . . I received a note from **Bob Hannam** reporting the death of **Winthrop A. Stiles** on May 20 after a bout with cancer. After graduation Win joined Texaco and was with that company in Shanghai until World War II. He served in the U.S. Navy attaining the rank of Captain. He was associated with Kaiser Engineers International in Ghana and later joined the Agency for International Development and was posted in Tunisia, Turkey, and Afghanistan. In recent years he has made California his home. He is survived by his wife Muretta, a son, Winthrop, and a daugther, Heather. His widow lives at 345 Lee St., Santa Cruz, CA 95060.

Fred Altman, Box 2303, Falls Church, VA 22042, retired April 1, 1973 and is now working again for three years at Cybercom as a senior scientist. Hobbies are hiking, square dancing, and computer (Epson PX-8). He travels to Europe every year. His son, Charles F. (Rick) is a professor at the University of Iowa in French, comparative literature, and cinema departments. He has two adopted Korean children, a boy and girl. Daughter Jane Lamond is a night shift nurse supervisor. Daughter Ann teaches programming at Sperry.

I very much appreciate the many of you who have communicated with me directly when you had news to report. I have not always acknowledged your contributions but I want to assure you I am grateful for them.—**Alice H. Kimball,** Secretary, P.O. Box 31, West Hartland, CT 06091

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Fred Altman of Falls Church, Va., retired in April 1973, working again for three years at Cybercom as a senior scientist. His hobbies are hiking, square dancing, and his computer. He travels to Europe every year. His son Charles is a professor at University of Iowa and has two adopted Korean children. Daughter Jane Lamond is a nursing supervisor. Daughter Ann teaches programming.

L.P. "Pete" Reitz of 700 Mexico Pl., Palo Verdes Estates, CA 90274 writes, "It is my sad duty to report the death of my very dear friend

R. L. Adler, '37

and our classmate, **Robert Lee Alder** of Garland, Tex. He died of a heart attack on April 6, 1985. Survivors are his widow Obera Lee and a son, Robert Lee Alder II. His will contained a bequest to establish a scholarship for junior and senior students at M.I.T. Bob was a pioneer in the oil instrumentation field related to information retrieval in oil exploration and development. After his retirement he was in great demand as a consultant. From 1972 to 1976 he held positions as assistant to the president and as director of engineering for Martin-Decker Co., Santa Ana, Calif. He worked as an instrumentation consultant in 1971 to 1972; manager of engineering, Technical Tool Corp., Glendale, Calif., 1966 to 1971; project engineer and project manager for Byron-Jackson Inc., Los Angeles, Calif., 1960 to 1966; engineer, Varney Corp., El Segundo, Calif., 1958 to 1960; research engineer, Roy C. Ingersoll Research Center Borg-Warner Corp., Des Plaines, Ill., in 1957 and 1958; and research manager supervisor and engineer for Lane Wells Co., Los Angeles, from 1944 to 1957. Bob did post graduate work at M.I.T. in electronics, optics, general physics and nuclear physics and at the Calif. Inst. of Technology in ultra high frequency techniques. He was a member of the American Institute of Mining, Metallurgical and Petroleum Engineers and The Petroleum Club of Los Angeles. Bob held a score of patents related to oil drilling techniques and was the author of a number of technical papers. We became re-acquainted here in southern California during the last several years prior to his moving to Texas in 1983. We became great friends and it is a deep personal loss not to have him with us. Looking forward to our 50th reunion in '87. See you there!"

It is with deep regret that I report the passing of **Philip Scarito**, Box 136 Douglasville, PA 19518, who died in the fall of 1983. Phil retired as plant manager of the Tenneco Chemical Plant in Burlington, N.J., in 1978 and moved to be near his daughter.—**Robert H. Thorson**, Secretary, 506 Riverside Ave., Medford, MA 02155; **Lester M. Klashman**, Assistant Secretary, 289 Elm St., Apt. 71, Medford, MA 02155

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Hal Chestnut was presented with the 1985 Bellman Control Heritage Award of the American Automatic Control Council, for distinguished lifetime career for contributions to the field. Hal has authored *Servomechanisms and Regulation Systems Design* and Systems Engineering Tools and *Systems Engineering Methods* and has made significant contributions to the guided missiles and marine systems programs at General Electric Company. . . . **Harold Hindman** became chairman and chief executive of Instron Corp., having served as president. . . . **Bill DeLia** now enjoys retirement after a career of highway and building construction in central New York State. . . . **Irv Peskoe** continues as mayor of Homstead, Fla., where the city owns its hospital, electric generating system and waste water treatment plant.

We are saddened by reports of death of **Robert Larkin** and **John Dodge**. The Quincy, Mass., *Patriot Ledger* reported retired Air Force Colonel **John A. Dodge** served during World War II in China, India, and Burma where he received the

Bronze Star, Army Air Force Medal, and the Cloud and Banner Medal from the Republic of China. He directed a top-secret research project for the intercontinental missile project, coordinating the work of 5,000 persons who developed a nose cone that would withstand the heat of reentry. The project produced some of the earliest photographs of Earth from space. John's other assignments have included directorship of the Apollo project for Avco Corp., in Everett, Mass. —**Hal Seykota,** Secretary, 1415 Seacliff Dr., N.W., Gig Harbor, WA 98335

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Some of these notes are a carry-over from material received prior to the 45th reunion.

John Casey, who retired in April as president and chief executive officer of Pan Am World Services, a subsidiary of Pan Am Corp., wrote that he and Dawn could not attend the 45th because of a special assignment with Pan Am (overseeing the details of the acquisition of Pan Am's Pacific Operation to United Airlines). John gave his best regards to the 1940 gang which, of course, was the best class of all. Nothing will interfere with the 50th, he says.

Dick Falls writes that he has been retired since July, 1982. Has done some traveling including three months in Australia and a trip around the United States in his motor home. Now has nine grandchildren.

Jack Kirk wrote an interesting letter to **Jim Baird** since he and his wife, Elizabeth, were unable to attend the reunion. He recalls that "some of us" got involved "for some reason" with Wheaton College. Also he remembers that whenever there was a conflict of interest regarding events at M.I.T. or Wheaton, in the ensuing tug-of-war the Wheaton girls always won! Fifty years later things remain the same. Elizabeth (Wheaton '39) and their oldest daughter, Susan, (Wheaton '64), together with about 30 other Wheaton alumni and/or faculty left on June 7 for a two-week trip to the Soviet Union. Hence Jack remained at home to (1) figure out how to finance this caper and still eat, (2) supervise (with some professional assistance) a menagerie of 12 cats, one dog, one rabbit, four chameleons, one tank of tropical fish and two grandchildren; to say nothing about the camellias, gardenias and orchids flourishing in both houses. He had the menagerie problem since Susan's husband died suddenly approximately two years ago. Jack wanted to update the count of grandchildren from seven to eight. Also, another interesting statistic; he can boast of three Ph.D.'s in the family: Susan, mentioned above, Thomas, and his wife, Andrea.

Norm Klivans sent a letter to all members of the reunion committee and officers of the class thanking them for their contributions and participation. He made a few suggestions for the 50th, while his mind was still "tuned in" to the reunion!

(1) We should make arrangements for 1990 now. We were clobbered in '80 since we waited until the year before.

(2) The committee and others should be working on details and arrangements by late 1986 or early 1987.

(3) There are a number of classmates more interested in off-campus (weekend) stuff—hence this should be planned carefully.

(4) There should be less emphasis on golf or tennis. Interest in this at 45th quite nominal and it will be less for 50th.

(5) The committee should be sizeable in case of illness, accident, etc. We should consider an organizational meeting in either June, 1987 or 1988. This also could coincide with a Technology-Alumni day event.

Any suggestions or recommendations regarding the 50th are welcome.

Jim also sent a note received from **Joe Havins** thanking all for the enjoyable 45th reunion. He had not been to one for 20 years. He suggested country club portion of 50th be held in a place with access to reasonably-priced motels and to RV and other camping areas, giving more choice for those economy minded.

An article in the Springfield, Mass., Sunday *Republican* newspaper, on June 2, covering the sale of businesses outlined the success that **Ed Wallace** had when he sold his company, Wallace Manufacturing of Enfield, Conn. in 1982 to Omark Industries. At 67 he still heads the company he founded 35 years ago to manufacture garden tools and hedge trimmers, although he does not have an employment contract. "The day we closed the sale, I cried, but all the way to the bank" he told a group of 50 small business owners who attended a seminar on selling closely-held businesses. Ed turned down a number of offers before settling on Omark, a company he felt would assist and allow Wallace Manufacturing to continue to grow. Ed is inclined to take an afternoon off for a round of golf these days, as well as developing outside interests. He recently formed Oppven, a Hartford-based venture capital company, with a group of Connecticut investors.

Received letters from Marion and **Gary Wright** and Lindsey and **Bill Merrill** indicating how much they enjoyed the 45th reunion, in particular Woodstock. After the reunion Gary and Marion flew out of Boston to Newport News, Va., where they stayed for a week. This gave them a chance to visit Williamsburg and Bruton Parish, where they were married in 1941.

I left the sad news to the last. Dr. **Ernest C. Chilton** passed away on January 22 at his home in Menlo Park, Calif. He had been emeritus professor of mechanical engineering at Stanford University, as well as a Fellow of the American Society of Mechanical Engineers. He leaves his wife, Nancy, and three sons. . . . **David Joseph Collins** of Wellesley Hills, Mass., died on April 13, after a long illness. He was former owner and president of the Atlas Color and Chemical Co., Inc., of South Boston, Mass. David had been quite active in civic affairs including being past president of the Wellesley Boosters and the Drysalters Club of New England and a former trustee of the Newton-Wellesley Hospital. David is survived by his wife, Julia, two daughters and a son. . . . **Spencer M. Richardson** died on May 26. Limited news from his widow, Virginia, indicates that they were living in Quakertown, Pa., at the time of his death. . . . That's all the news for now.—**Donald R. Erb**, Secretary, 10 Sherbrooke, Dr., Dover, MA 02030; (617) 785-0540

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Correction: Contrary to our October report, **Richard Herman Gould** *called to say he is alive and well.* . . . Received a note from **Henry Avery** of Ponte Vedra Beach, Fla., the former class secretary saying that he will be coming to our reunion next year. He retired from U.S. Steel some time ago but is still very active in his merger and acquisition business. He is on the board of the Panelgraphic Corp., who manufacture unscratchable coated film. Hank has five grandchildren and faithfully calls when he comes to the Cape.

Robert Raiklen, inventor of the B-1 did not write again; **Robert Wallace Blake** sheds some light on this fascinating story. Harold started in 1938 at M.I.T., class of '41, but is listed in the *Alumni Register* as class of '47 with a S.B. and S.M. in mechanical engineering. He is the owner of an aerospace consulting firm in Long Beach, and is an associate fellow of A.I.A.A., and so is, coincidentally Bob Blake. At the time the B-1 project was initiated, **Robert Raiklen** was the chief engineer of the Saturn II program at the Rockwell plant at Seal Beach.

George B. Boettner has retired but is still working as a consultant at Corning Glass. He has four grandchildren and will try to come to the reunion. . . . **Holbrook A. Bourn**, who was bureau director of the Hartford Health Department for Food and Sanitation, has retired from this demanding job. He has seven grandchildren and does not think that he can attend our reunion. . . . **Joseph C. Bogert, Jr.** was a planning executive with General Electric in Philadelphia has retired. He is unable to attend our reunion. . . . **Wallace Blanchard, Jr.** is still working as an estimating engineer in Hyde Park, Mass. He has eight grandchildren and we may well see him at our reunion. . . . **Roger G. Blum** of Greenwich, Conn., has retired but continues his consulting engineering. He recently completed a fabulous trip to Nepal. I am looking forward to seeing my old buddy and his wife again at the reunion. . . . **Merlin J. Block** of Chevy Chase, Md., has also retired. He likes Maui, Hawaii. He is hopeful of attending the 45th and reports his sliderule rests peacefully at the M.I.T. Museum.

Alfred B. Booth is executive vice-president of Production Sharing International, Inc. of Southport, Conn. The corporation is dedicated to the creation of jobs and foreign exchange in developing countries in the Caribbean through sharing production. He travels constantly in the Caribbean, Central and South America; Singapore, Manila, Thailand and Japan. Alfred has two grandchildren and will be at the reunion with his wife and Bea and **Peter Kelly**. His distinguished offsprings are: Dr. G.K. Booth, neurologist, VA Hospital, San Francisco; Dr. S.P. Booth, D.M.D. practicing dentist in Southport, and Carolyn Booth comptroller in a C.P.A. firm in San Francisco. Alfred enjoys boating on Long Island Sound in a 27-foot Concord with twin 225 Hp. Mercury's. He is a member of the Minute Man Yacht Club of the Saugatuck River Power Squadron. Congratulations Alfred, we'll see you.—**Joseph E. Dietzgen**, Secretary, Box 790, Cotuit, MA 02635; (617) 428-2534

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I must open this edition of the Notes with obituaries for three departed classmates. **Martin H. Winter**, Paramus, N.J., died in February after a five-month illness. . . . **Aurelio C. Hevia** of Miami, Fla., passed away in May. . . . **William R. Lacy**, Orlando, Fla., died in July. Bill's brothers Tom and John (M.I.T. 1948 and 1942) kindly sent along some biographical information. Bill was a member of Beta Theta Pi at M.I.T. During World War II he served in Europe with the Coast Artillery, and later rose to the rank of Lt. Col. in the U.S. Army Reserve. Following World War II he worked for a few years in industry and then in 1952 became a citrus grower in the Orlando area, remaining active in that occupation until his death. Besides his two brothers, Bill is survived by his wife, four daughters, and two grandchildren. Bill's father, Clive W. Lacy, was also an M.I.T. alumnus, Class of 1915. We extend our condolences to Angela Winter, Estela Hevia, Marian Lacy, and the other members of their families.

A very short note from **Peter G. Von Wiesenthal** says that he is now retired and devoting more time to thoroughbred breeding and racing. I wish I could tell you where. . . . **James B. Reswick**, of the Veterans Administration Medical Center, Washington, D.C., has been serving on the National Research Council's Committee on Trauma Research. This committee recently completed a report, *Injury in America, a Continuing Public Health Problem.* . . . From **Bob Caldwell** we hear that, contrary to **Jim Hoey**'s report, **Charlie Burnham** never made it from Martha's Vineyard to visit the Caldwells in Boca Grande, Fla. Bob says the lamp is still in the window and "the world's finest tarpon fishing" is still waiting. Where are you, Charlie?

Jim Hoey has sent a big clipping from the *Engineering News Record* which lists the top 500 engineering design firms in 1984. Number 342, with billings of $5 million to $6.99 million, is **Gene Eisenberg**'s LEA Group, Boston.

Your letters are appreciated, but I would be

grateful for a higher ratio of news to obituaries.—**Bob Rorschach**, Secretary, 2544 S. Norfolk, Tulsa, OK 74114

44

As of this writing, there are great expectations for the Williamsburg mini-reunion. The reponse has been terrific and future get-togethers may transpire as a result. If you couldn't make it this time, keep in touch, and be sure to plan for that 'next time!'

One who will be missed is **Arthur "Pete" Peterson** who had to pass it up this time because of a heart attack. He is up and around and should be hiking the four miles around their lake! Keep walking, Pete! . . . Hot news item in the August issue of *Boston Magazine*! "KENNEL, Best: Holiday Kennels, 104 Pearl St., Brockton, Mass. Wonderful facilities; you can leave your dog without guilt. They even offer a doggy Day of Beauty." Your classmate-owner, **Norm Sebell**, knows how to treat man's best friend!

It is with sorrow that we report the deaths of several classmates. **Palmer Derby**, a pioneer in the development of microwave cooking and recently retired vice-president from Raytheon Co. in Lexington, died of a heart attack on June 23, 1985. He joined Raytheon in 1942, was elected a vice-president in 1967, and named director of new business analysis in 1976. He had been assistant general manager of the company's microwave and power tube division. He held 24 U.S. and 33 foreign patents in microwave technology. In 1947 he received a U.S. Navy commendation for contribution to development of electronic countermeasure systems used during World War II. Our sympathy is extended to his wife, Marnie, two daughters and three grandchildren.

Albert J. Seymour died May 3, 1982, in Amsterdam, Holland, of an apparent heart attack while on a business trip. He was a first lieutenant in the U.S. Air Force during World War II. A chemical engineer, he was employed as a technical director for the B.F. Goodrich Co. for 25 years and for the last ten years worked for Crawford & Russell of Stamford, Conn., as a project manager. He was involved in various youth sports programs in Orange, where he lived, and was named Orange Man of the Year in 1973. He leaves his wife, Janet, four children and two grandchildren. . . . Word was also received of the death of **Frederick B. Meier** of Monroe, Mich., from his wife, Diana, via M.I.T. records.

Stanley Berinsky of Sunnyvale, Calif., died March 4, 1985, according to his wife, Ruth, also through the alumni records office. We do not have any further information. Some of you will remember "Stan" from World War II days when he and his buddies were struggling OCS candidates. Our heartfelt sympathy goes to these wives and their families. Time and distance has separated many of us over the years, but we forever "remember when–" and reminiscing is still a favorite pastime!

To all: best wishes for the holidays and a very happy and healthy new year!—Co-Secretaries: **Andy Corry**, Box 310, West Hyannisport, MA 02672; **Lou Demarkles**, 53 Maugus Hill Rd., Wellesley, MA 02181

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Apologies for not making the October issue but I was down East in New Brunswick doing the St. John's River with a few sailing cronies at the time notes were due. And it seems strange that we trust you have had a Happy Thanksgiving and will have a Merry Christmas as these notes get penned on a beautiful mid-August Sunday morn.

In the months ahead you shall be brought up-to-date on the worlds of your classmates as set forth in the 40th reunion biographical data put together by Dee and **Frank Gallagher**.

In behalf of your classmates may I again thank those of you (and there were many!) that made our 40th Reunion Gift of $1,120,000 a surprise and pleasure to all '45ers. You cannot imagine how proud we all were on Technology Day last June to hear Reunion Gift Chairman **Chris Boland** make his great financial proclamation. Again, Chris, congratulations for a job well done. And for those of you that did not participate in this financial success don't despair as our historic 50th is less than ten years away!

Congratulations also to our 40th Reunion Committee for another job well done commencing with cocktails and dinner at the M.I.T. Museum prior to Pops on Thursday, June 6, through brunch at the Wequasset Inn in Chatham on Sunday, June 9. It should be noted that this was not a typical 45th reunion weather-wise as we only had a couple of hours of rain Saturday afternoon (as compared to the usual two days of torrential downpour!).

Reunion attendees—be it Cambridge only, the Cape only or combination thereof in more or less alphabetical order (I have always had trouble!) were: Eva and **Peter Agoston**, Delores and **Bill Beam**, **George Berman**, Jean and **Chris Boland**, **Al Bowen**, Ellen and **Jim Brayton**, Hilda and **Manuel Cadenas y Adam**, Edie and **Nelson Chang**, **Dave Cohen**, June and **Frank Donahue**, Mary and **George Dvorak**, Pam and **Ray Elmendorf**, Janice and **Dave Flood**, Dee and **Frank Gallagher**, **Jim Gurney**, Vernie and **Roy Grammer**, Susanna and **Art Hall**, Nancy and **Charlie Hart**, Betsy and **Tom Hewson**, Lou and **Pete Hickey**, Mary and **Charlie Hooker**, **Mary Ruth Jeffries**, Ruth and **Jim Levitan**, Kate and **Bob Lohman**, Anne and **Bob Maglathlin**, Alice and **Tom Markey**, Lucille and **Les McCracken**, Louise and **Tom McNamara**, **Bill Meade**, **Art Miller**, **Warren Miller**, Carol and **Nick Mumford**, Louise and **Walter O'Connell**, Jean and **Charlie Patterson**, Carol and **Jim Pickel**, Marie and **Gerry Quinnan**, **Bob Roth**, Peggy and **Bob Shuchmacher**, Fran and **Clint Springer**, **Spence Standish**, Jimmie and **Tom Stephenson**, Elinor and **Ed Stoltz**, Paddy and **Jeptha Wade**—for a total of 44 classmates!

My apologies for any errors; fortunately all of you know how difficult it is to remember yesterday. Congratuations to our first time attendees—Mary and **George Dvorak** all the way from Seattle plus Pam and my thesis partner **Ray Elmendorf**, **Bob Roth** and **Dave Cohen** all from greater New York.

The Technology Day activities have been discussed elsewhere and your classmates participated as their little hearts desired. The Wequasset Inn program followed the usual '45 format of total informality starting with Friday evening's cocktail party and clambake. You will be pleased to learn that the old P Clubbers no longer can consume alcoholic beverages to their former degree. On the other hand, there are still one or two classmates that can put away four bowls of steamers plus two pound lobsters—quite a feat for one under a strict doctor's diet. Very little golf on Saturday as none of our classmates had the patience to wait in line. Congratulations are in order for the hale and hearty that walked Nausett Beach—particularly Ellen Brayton who covered twice the distance of anyone else. And we should not forget those that sought out the sand dunes; they must have been reliving their Crane's Beach days! Yes, there were even a few bridge games as we slow down our torrid pace of yesteryear.

The usual brief—but official—class meeting was held prior to our Saturday night banquet. Officers for 1985-1990 are: **Chris Boland**, President; **Clint Springer**, secretary; **Jim Pickel**, treasurer; plus the following vice-presidents—senior vp, Northeast, **Frank Gallagher** plus **Charlie Hart**, Boston; **Al Bowen**, New York; **Jake Frieberger**, Southwest; **George McKewen**, Chicago; **Tom Stephenson**, Pittsburgh; and **Sherry Ing**, Western.

The 40th Reunion Gift was a pair of pewter liquor or shot cups duly inscribed; and congratulations to Louise McNamara for her excellent choice. Activities Chairman **Charlie Patterson** served as our banquet toastmaster and brought the house down with some of his remarks which are ad-libbed as follows: **Jim Pickel** received the David Stockman Trophy for the fine job he did as reunion treasurer. Commiittee members thanked Jim for the many dinner meetings at Lockobers; committee wives thought the day trip to Nantucket in January to discuss alternate sites was a nice touch—and a special thank you for Friday night's cocktail party which only ran 37 percent over budget. **Tom McNamara** and **Bob Maglathlin** will share the Fella Gintoff Trophy for having changed the least from their V-12 days. The F. Curtis Canfield Award was a tough call as there were many qualified candidates; however, **Tom Markey** proved to be the winner as that individual who continues to have the bearing, posture, and size that we all held so sacred as part of our military bearing! And there were many other tongue-in-cheekers that slip my mind.

Following dinner we shared a band playing music of the 40s with Harvard Med School Classes of 1945 and 1950. Unfortunately, Sunday was a lost day for your secretary as he suffered through and with an abscessed bicuspid—but such is life.

In closing, we must report another death: **Clarence "Red" Howell** of Mercer Island, Wash., on Saturday, June 8. Red left the V-12 for V-5 in early '44 but returned for both a B.S. and M.S. in Course XVI. After a few years at American Airlines, Red spent his remaining career at Boeing. **Nick Mumford** advises that Red is survived by wife Barbara, two sons, a daughter and at least three grandchildren. Red was another '45er who had planned to attend our 40th—also a former crewer.—**Clinton H. Springer**, Secretary, Box 288, New Castle, NH 03854

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It's like That Was The July That Was, when a flurry of news arrived from all directions. The earliest was a call from **Dave Longmire**, a Course X chap I never knew, revealing he's been in Denver for seven years. What a tale he has to tell! Sometime after graduating in the September class, a non-V-12er, he enlisted in the Air Force where he spent the Korean years. After that he returned to academia to get his Chem. Eng. Ph.D. at the Univ. of Wisconsin in the mid fifties. He spent six years with Mobil before realizing there were alternatives to engineering. Along the way he lived a while in Houston where he bumped into **Glen Dorflinger**, about whom we've recently written. Dave migrated back east to "do straight time" on Wall Street while getting his R & R in Fairfield, Conn.

Then around 1979 the Big Apple palled to the point he packed it in and moved to Denver—a comfortable section of Littleton, actually. He's still in the securities field, presently vice president of Dain Bosworth. But the best part is what brought us together. Turns out he saw my mug shot and bio in a reunion flyer and found we have a mutual love of hiking around in the mountains. The end result was a grand, grueling 16-mile hike together in the Eagles Nest Wilderness Area of the Gore Range the end of July.

Meanwhile I received a long-awaited, newsy note from **Jim Corbett**, ex-roomie and XVI colleague. Jim's worked for Grumman since "day one," and is on the brink of retirement (aren't we all?) next year, when he and wife, Fran, plan to move to elder statesman category in Heritage Village, Conn. It's near grandchildren, has low taxes, two golf courses, three swimming pools, and is "closer to M.I.T. reunion activities." How thoughty of you, James. Now if you can prod **Larry Body** and **Stan Young** into joining the 40th, we've got it made!

Then at the tippy end of the month I called Prez **Jim Goldstein** to find out who our class officers are (for Alumni office use). Mostly there's Jim and Jim as on-line president and secretary; **John Gunnarson** as reunion chairman; and **Ernie Buckman** as the 40th gift committee chairman.

And it seemed only right to make **Russ Dostal** our secretary emeritus in recognition of his many years of service to the Class. Jim also passed along a couple of fascinating bits on two of our noteworthy classmates; **Dick Steele** who runs an impressive contracting association out of Silver Spring, Md., and **Marshall Tulin** (mentioned a while back), professor of ocean engineering at University of California Santa Barbara, who developed a revolutionary breakthrough in anticavitation screws.

Then to close out the month **Don Burke**'s friendly letter arrived. It seems he and wife Pat had a three-week land tour and 12-day cruise to the North Cape—of Norway! Returning to St. Pete, they found invitations to view the Shuttle launch from Cape Canaveral, courtesy of Rockwell International via Larry Body. On the serious side Don pointed out the puzzling aspect of classmates who've been turned off about class and mates and, more importantly, the possibility of giving bright, needy youngsters the chance (as a number of us were) to be admitted to one of the world's great institutes of learning. Something for all of us to ponder when it comes time to contribute to the 40th Reunion Gift. Happy Holidays, amigos!—**Jim Ray**, Secretary, 2520 S. Ivanhoe Pl., Denver, CO 80222

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Dennis Allegretti wrote about his plans to spend increasing amounts of time in the Boston area. His law practice in Chicago remains extremely active and highly successful. The firm now includes 30 lawyers together with a large staff. His firm has taken a major step in a new direction by joining with a newly formed firm in Boston. Their Boston office will improve access to their clients in the New England area. The additional firm brings Dennis into partnership with his dear friend and college roomate, **Ben Brettler**, who has been pursuing in recent years his vigorous "second career" as a lawyer. The Boston firm will also provide Dennis and his wife, Marge, with the opportunity to spend increasing amounts of their time at their second home in Wellfleet on Cape Cod. Marge pursues her professional art career while spending the entire summer at the Cape. She oversees their Customs House Gallery which is located in a restored 1863 customs house building on the harbor in Welfleet. Dennis' older son, Greg, M.I.T. class of '78, is practicing architecture in New Mexico. His younger son, Dan, has just graduated from Colby with Phi Beta Kappa and cum laude distinctions in economics and French. Dan will be beginning law school at Georgetown. Just as Greg and Dennis are fellow alumni of M.I.T., Dan and Dennis will be fellow alumni of Georgetown.

Mario DiQuilio will be an exchange professor at the Universidad Autonoma Metropolitana-Aycapaotzalco at Mexico City. He looks forward to contacting M.I.T. alumni while he is there." **Bob Mueller** continues his dual career as an artist and scientist. Recent acquisitions of his art by major art museums throughout the world include the Metropolitan in New York City, the Victoria and Albert in London, the Berlin, Munich and Vienna State museums, and the Montreal Museum of Fine Arts. He is working for Bellcore doing research and has created inventions for graphic computer input devices. . . . **Stanley Chao** is founder, chairman and CEO of Boston based Advanced Electronics, Inc., a contract manufacturer to the computer industry and assembler of PC boards. He founded Advanced in 1976 and the company has grown to over 400 employees. Recently Stanley was elected a member of the board of directors of Blue Cross of Mass. . . . **Sydney Crook** of New London, N.H., campaigned for election to the town's board of selectmen. Sydney was born in the house he now lives in. Before retiring he worked for a number of companies in the Boston area on missile systems and then formed his own consulting firm.

Lucien Schmitt, professor, mechanics and structures, teaches at University of Calif. in L.A. Lucien was recently elected to the National Academy of Engineering. He has done pioneering work in structural synthesis, combining finite element analysis and nonlinear programming algorithms to create a powerful class of modern structural design methods. . . . **Henry Morgan** is dean of the School of Management at Boston Univ. Recently he became a director of Kloss Video Corp. in Cambridge. . . . **Walter Lowrie**, president of Martin Marietta's aerospace divisions and corporate vice-president will be retiring in the fall. . . . **Don Atwood** is executive vice-president of General Motors Corp. Recently he was re-elected by the National Academy of Engineering to their Council, which is the governing body of the Academy and is comprised of 12 elected councillors and six elected officers of the Academy.

During the past several months, several members of our class have died. **Peter Johnson** had been with Lockheed Missiles in San Jose. He received his degree in electrical engineering. **John Christopher** had been living in St. Louis. **Ralph Segal** was president of Masspark Liquors before his death. He had been living in Roslyn, NY. **Dave Selengut** lived in Schenectady before his death. His wife, Judith, still lives there. On behalf of the class of 1948, I offer sympathy to the families of our classmates.—**Marty Billett**, Secretary, 16 Greenwood Ave., Barrington, RI 02806; (401) 245-8963

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First, since this is the Christmas/Hannukkah issue it seems timely to report on the elegant, delicious and delightful holiday dinner which the 35th reunion committee was privileged to share at the home of Pam and **Mickey Ligor** last season. Many of those who had worked so long and hard for our successful 35th reunion gathered again for a festive evening. The food was prepared by the guests as well as the host and hostess, and it was delicious. The house and the people were all in holiday decor and, as usual, the friendship was the best part of it all. Attending were: Dorothy and **Jim Christopher**, Nell and **Fletcher Eaton**, Doris and **Mel Kurth**, Pam and **Mickey Ligor**, Roz and **Stan Margolin**, **Barbara Feeney Powers** and Sunny and **Frank Schneider**. The missing committee members, Sunny and **Frank Hultsit** were in Florida so they were included by our telephoning them.

The joint reunion with the classes of 1947, 1948 and 1949 was the gala it was planned to be. The weekend began with a formal ball at Rosecliff in Newport, R.I. This beautiful building created a setting that transported the guests back to the early years of this century. The cuisine was equally amazing. Each of the ladies received a lovely pendant engraved with the M.I.T. beaver. The remainder of the weekend was, indeed, a trip. The clambake in all it's tradition, the sports, the champagne brunch at the Viking Hotel and the waterfront all contributed to a wonderful weekend. Perhaps nicest of all was the presence of so many classmates who had not previously known each other and used this occasion to make new friends. Certainly all who were at Newport look forward to other reunions. However, you do not have to wait until the next get-together to purchase a '49 sweater or Lazercraft M.I.T. bookends. You can order by calling Pam Ligor at (617) 395-1486.

Robert Gillmeister also sent news of the weekend to me and added his "large vote of thanks" to those who put together this memorable weekend. The lucky folks who attended include these classmates and their spouses: **Alex D'Abbeloff**, **Antonio Armenante**, **Nicholas Assaf**, **Richard Cotton**, **Russell Cox**, **Wallace Douglas**, **Frederick Fletcher**, **Robert Gillmeister**, **Charles Holmes**, **Sidney Howell**, **Frank Hulswit**, **Davis Keniston**, **John Kirkpatrick**, **John Kunstadter** and **Gerry Kunstadter**, **Demete Ligor**, **Leonard Newton**, **Herbert Spivack** and **Thomas Toohy**.—**Barbara Feeney Powers**, Secretary, 200 Temple St., W. Roxbury, MA 02132

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James M. Lydon presently executive vice-president of Boston Edison Co. was recently named a director of the Shawmut Corp., Boston, Mass. . . . **Vincent A. Amato** launched his hobby shop out of his father's plumbing store as a sophomore in high sschool and now runs three hobby shop businesses. At the ripe age of 14, Vinnie threw his life savings of $120 into the venture. He still has his first checkbook which shows check #1, dated May 28, 1940, written on the Central National Bank, now part of Connecticut National Bank, for an order of airplane models from International Models, at $10.08. Forty-five years and 6,000 checks later, he runs three hobby shop bussinesses and is active in many community organizations. He was recently elected to a two-year term as chairman of the Middlesex County Chamber of Commerce. Last spring, he was chosen as the small businessman of the year for the State of Connecticut. He will also be included in the 1985 edition of Who's Who in American politics. Vinnie also collects antique cars, among which are two Maxwells and one Model T Ford.—**John T. McKenna, Jr.**, Secretary, 9 Hawthorne Pl., 10-H, Boston, MA 02114

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George B. Duhnkrack has been named president of a new company, U.S. Technology Corp., a wholly-owned subsidiary of U.S. Plastic where he has been vice-president in charge of research and development. U.S. Technology will manufacture abrasive plastic blast cleaning medias, a very important addition to the aircraft maintenance industry. . . . **Daniel P. Maxfield** recently retired from the U.S. Department of Energy after over 30 years of Federal service and has now established DAMA Associates, specializing in diversified incomes and international multilevel marketing. . . . **George L. Turin** recently was elected to the National Academy of Engineering for his outstanding contribution to communication theory and practice and for leadership in engineering education. George is dean of engineering and applied science at the University of California in Los Angeles. . . . **Aaron L. Brody** recently received the National Institute of Packaging Award for Packaging Achievement for his lifetime contributions in aseptic, controlled atmosphere and shrink film multiple packaging. Aaron is vice-president, Strategic Studies for Schotland Business Research, Inc. in Princeton, N.J. . . . Dr. **W. Gerald Austen**, chief of surgery at Massachusetts General Hospital recently was elected president of the American Surgical Association. Dr. Austen has served as president of the American Heart Association, the Massachusetts Heart Association, the Association for Academic Surgery, and The Society of University Surgeons, and presently serves as a Regent of the American College of Surgeons. He received the Gold Heart Award of the American Heart Association and the Paul Dudley White Award of the Massachusetts Heart Association.

Our 35th reunion will run from June 4 through June 6. Mark that on your calendars as our reunion committee is planning a great program. —**Gregor J. Gentleman**, Secretary, 600 Holcomb, Suite #1, Des Moines, IA 50313

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There is only one item of news this month, from **Hank Hohorst**. Hank is running his own consulting company, Hohorst Maine, specializing in railroads and ships. Additionally, he is the major stockholder and chief executive officer of two

short line railroads in Tennessee and Kentucky. That sounds like it might be fun. He and his wife Joan have three children, all married.—**Richard F. Lacey**, Secretary, 2340 Cowper St., Palo Alto, CA 94301

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Remember way back last June when a Jordanian Boeing 727 was hijacked shortly before take-off from Amman? Well, our classmate **Landry T. Slade** and his son William, 18, were two of the passengers who were on board and released 30 hours later, just before the terrorists blew up the plane. Landry, an assistant to the president and associate professor at the American University in Beirut, was on his way home to join his wife. She had left earlier to visit family and attend the graduation of son Lawrence, 20, an aerospace engineering major at Georgia Tech. We're happy that they were not injured in what must have been a traumatic experience.

We heard about **Zane Yast**'s being elected to the board of directors of the Connecticut Society of Architects. Congratulations Zane!—**Wolf Haberman**, Secretary, 41 Crestwood Dr., Framingham, MA 01701

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A most welcome letter from **Bill Zoino** informs us that he has been elected Zone I vice-president, American Society of Civil engineers, for the period from October, 1985, through October, 1987. He has already served as president of the Boston Society of Civil Engineers, the only professional society in the country older than ASCE. Congratulations, Bill! Bill and **Don Goldberg** operate Goldberg-Zoino & Associates, Inc., in Newton Upper Falls, Mass. They have recently opened a drilling and test boring company to supplement the engineering services performed out of their other seven branch offices. . . . **Ray Cairns** has recently been promoted to vice-president in the Du Pont Co., where he has also become head of that company's Information Systems Department. He has been with Du Pont since 1962, when he received his doctorate from M.I.T. Over the years, he has risen rapidly, as they say, from research metallurgist to assistant director in the Design Department to manager of corporate planning activities to assistant director of the Information Systems Department to managing director of that department.

Dan Lickly sends word that he is the president of a new company called Applied Reasoning Corp. in Cambridge, Mass., which is developing an expansion board for an IBM PC or XT that will make the computer run five times as fast—faster, he says, than an IBM PCAT. . . . It is impossible to keep up with the activities of **Paul Gray**, but he probably deserves an occasional mention here as well as in the other sections of *Technology Review*. Back in May, for example, he was a major speaker at the National Academy of Engineering symposium at which its Decade III Program was announced. That program is a decade-long effort to bolster U.S. leadership in technology and enhance industrial competitiveness. In his spare time, by the way, Paul is doing an excellent job as president of M.I.T.—**Edwin G. Eigel, Jr.**, Secretary, 33 Pepperbush Lane, Fairfield, CT 06430; **Joseph P. Blake, Jr.**, Assistant Secretary, 74 Lawrence Rd., Medford, MA 02155

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It is worded so well in Ecclesiastes that many copy the verse; but so often the time to act passes quickly and we end up cleaning up the unimportant after the storm of vitality is gone. There is indeed a time for living ,and as the years go by it becomes more apparent that what is deferred is not to be, and that the early elemental lessons

A. Wahlberg, '55

were forged out of the same realizations of a foregone cycle.

It is with regret that we have learned of the deaths of two of our classmates. In a recent letter, Rinaldo Del Gallo informed us that **Shanher R. Bagade** died in January, 1979. At the time of his death, he was employed by a division of AVCO Corp. in Cincinnati, Ohio. He is survived by his wife, Malati, and three children. Also, in April, 1984, **Thomas C. Wood** passed away. He resided in Manhattan Beach, Calif., at the time of his death.

George B. Raymond has been honored as a Distinguished Citizen of the Year by the Middlesex, Connecticut, County Chamber of Commerce. The award is presented to individuals who have made an oustanding contribution to the county. George is the former chairman and president of Raymond Industries, Inc. After graduation he joined the Hamilton Standard Division of United Technologies for three years. In 1958 he joined Raymond Industries where he became president in 1966 and chief executive officer in 1967. He served in that position until February, 1985.

George is also past chairman of the board of Teleco Oilfield Services, Inc. He was a director of Liberty Bank for Savings and United Bank and Trust Company. Currently he is a director of the Andersen Group, Inc., First Connecticut Bancorp and Raymond Engineering, Inc. His past participation in business organizations includes director and president of the Middlesex County Manufacturers Association, director of the Hartford County Manufacturers Association and membership in the Young President's Organizations.

In the Middlesex County community he has served as director, general campaign chairman and president of the Middlesex United Way during the late 1960s and the early 1970s. He was chairman of the Second Century of Service Campaign for the Northern Middlesex YMCA from 1983-84, and served as trustee from 1983-85. At Middlesex Memorial Hospital he was chairman of the board of directors from 1979-80 and general campaign chairman of Campaign '74 in 1973-74. From 1973 to the present George has served as a director of the hospital. He was a director of the Middlesex County Chamber of Commerce from 1967-78 and was a member of the Middletown Rotary Club from 1968-81.

Allen H. Wahlberg has been named chief financial officer of the Turner Corp. Allen has been vice-president and controller of The Turner Corp and its predecessor, Turner Construction Co., since mid-1980. He had held the position of controller for the previous seven years.

He joined Turner Construction Co. in 1956 as a field engineer on a construction project. He subsequently held a variety of field and office assignments in New York, Milwaukee and Chicago. In 1966 he was named senior cost engineer in the Chicago office, and in 1969 was appointed chief cost engineer for Turner Construction Co. He was appointed assistant treasurer the following year and was named controller in 1973.

He also serves as president and treasurer of Turner Construction Co. Foundation. He is a member of the Financial Executives Institute, the National Association of Accountants and the Construction Financial Management Assoc. Allen is a councilman in the borough of Ho-Ho-Kus, N.J., where he resides with his family.

Bob Dyck has returned to teaching the subject of planning at Virginia Tech after a number of years as director of International Programs for the university. His focus is on strategies for developing regions. . . . **David Peterson** reports that he and his family have moved from Duluth to New Ulm, Minn. He has taken the position of superintendent of utilities, which includes responsibility for electric generation and distribution, gas, water, sewage treatment, and district heating. . . . **Norman A. Robins** has changed positions in Inland Steel Co. He now is vice-president, technical assessment of the Chicago-based firm, moving from vice-president, research.

Barry A. Benepe notes that he is having fun and great satisfaction as an urban planning consultant. He is currently drafting a historic preservation ordinance for the Village of Easthampton, N.Y., and directing a farmers market program called "Greenmarket" for the Council on the Environment of New York City. . . . **Bill Chandler** and his wife Kris anticipate starting work on Ph.D.'s in management at the University of Arkansas during this academic year. . . . And, in a note from **Victor Tyler**, he informs us that he has recently taken up the cello. According to Victor, it takes the place of his slide rule, and he plays it about as well. Keyboard things don't take any skill or touch, Victor says; "I hope Bach doesn't resent my efforts as much as LaPlace did."

As a last item of news, I'll note the termination of the career of Marc Gross as a class secretary. Always a gentleman, Marc, a renowned attorney, has been a pleasant contrast to the curmudgeonly comment of his assistant from eastern Massachusetts. His regular flight from Rodeo Drive to Park Avenue excited intense jealousy in the other class co-secretary, who has moved seventy miles in almost as many years. Many thanks, Marc. Soon readers of this page will have new sources of class communication, as the old guard fades from the scene.—**Allen C. Schell**, Secretary, 21 Wegemere Ave., Winchester, MA 01890

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Clearly, it must have been a busy summer and fall for all of you, because our mail is still lighter than usual. We did learn, though, that **Harold Erichs** has been named director of purchasing at Stauffer Chemical Co. in Westport, Conn. Hal has been with Stauffer for more than 25 years and has held a variety of positions in manufacturing, planning, marketing, and purchasing. Most recently, he was director of raw materials purchasing for the company. . . . **Jack Raymond** is with the Harris Corp. where he is manager of business development. He and his wife Phyllis have three grown children, Steve, Pamela, and Scott. . . . **Hans Scharer** is director of engineering for the Farrell Division of Emhart Corp. Hans has served on the M.I.T. Educational Council for eight years and has also served as a director of the New Haven M.I.T. Club.

We were indeed saddened to learn that **Charles Diebold** had drowned while on a fishing trip in Canada this past spring. Most recently, he was vice-president of Thomson MacKinnon Securities, Inc., an investment firm, but from 1962 until 1982 he was with his family's bank, the Western New York Savings Bank. He was president and chairman of the bank at the time it was acquired by Goldome Bank in 1982. Charles and his wife Sheila were active members of the Buffalo community and extensively involved with the development of the Buffalo Zoo. . . . At Raytheon in Wayland, **Milton Jones** is a design coordinator in the Computer Aided Design Equipment Division. Milt and Muriel have three children, Madeline (23), Monica (20), and Melinda (17). Milt has been active in his church as a Sunday School teacher and as a lay reader.

You will see that this issue carries a new address for Nancy and me. We have moved across the channel from Boston's south end to South Boston, which is still part of the "center city." So,

when your travels bring you to Boston, give me a call either at my office (617) 227-4337 or at home (617) 268-9416. Merry Christmas and a happy holiday season to you all.—**Michael E. Brose**, 534 E. Broadway, South Boston, MA 02127

59

Well, you brought it on yourselves! Since we have received a veritable paucity of '59 notes this summer (not you, Bruce!) despite repeated pleading, begging and cajoling ad nauseam. And since Co-secretarius Primus (Collias) insists that this year we provide at least two or three paragraphs each issue, I'm going to start off with a brief version of *May Summer Vacation*. A week or so ago the Stones—Barbara Ann, Carolyn (10), David (5) and I—journeyed forth from Ithaca to drive around Lake Ontario. After a day or so in Niagara Falls (astonishing—but you've all been there, so I won't describe it), we moved on to Toronto—a remarkable city. We visited Ontario Place, the Royal Ontario Museum, Ontario Science Center (much larger and more interactive than the Museum of Science in Boston), Casa Loma—all reached by one of the finest public transit systems in the world. Then on to Kingston (Ont.), the Thousand Islands and home. Highly recommended; all of us were impressed—no mean feat. So now will you send in some items?

Just before our trip I heard from **Bob McAuliffe**. He called to talk a bit about his son Mark's interest in M.I.T. Bob is now executive vice-president of McBride Enterprises Real Estate Development. They're number one in New Jersey. Bob heads up their engineering and construction operations, as well as marketing, I believe. Bob related a Cornell story as well. It seems their Irish setter, Murphy, had suffered some very serious injuries; the local vets decided that Murphy would have to be put to sleep. Someone suggested the Vet School at Cornell, and now after a very tricky bone graft, the dog is home and almost as good as new. Go Big Red!

A week or so ago I talked to **Allan Bufferd**. He'd just returned to work at M.I.T. after a week at Princeton for a course in finance. He and Rhea are busy and fine. Son Steve just graduated from Lehigh and will spend much of the next year in China; Lauren, their daughter continues to live in Chicago. . . . The only other item of news comes from **Bruce Blomstrom**. In April he was elected president of Guardian Products, Inc. Guardian is the leading manufacturer of such medical products as walking aids (canes, crutches, walkers) and bath safety equipment. Bruce will be serving as president-elect of the M.I.T. Club of Los Angeles this year. That's one of the oldest clubs serving one of the largest alumni groups in the U.S.

Well, that's it except for very warm holiday wishes to all of you from the Stones here in Ithaca. And please drop a line in the new year—or call if it's easier (607-257-2249).—Secretaries: **Myer Kutz**, 320 Riverside Dr., New York, NY 10025; **Arthur Collias**, 24 Hemlock Dr., Canton, MA 02021; **Ron Stone**, 116 Highgate Pl., Ithaca, NY 14850

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Due to lack of space in the *Review*, my October class notes had to be held over until this issue. There is much to report.

Hal Bowers writes that he just was promoted as technical director of the Hughes Aircraft Industrial Electronics Group in Torrance, Calif. Hal has been at Hughes for 15 years since he graduated from Cornell with a Ph.D. in applied physics. . . . **Al Brennecke** wrote to say that "the Detroit contingent is alive and well." Last May **Ira Jaffe**, **John Crissman** and Al got together and "vowed to prove our manhood by entering the six-mile race." Somehow Ira managed to miss the event but Al and John managed to make it the whole way. A photograph attesting to this remarkable achievement was enclosed but it was unreproducable. The picture shows "John just starting to reach his cruising rhythm after six miles and Al desperately looking for the refreshment table." All three plan to clear their heads following the revelry in Cambridge next June by running the Charles River circuit (15 miles).

Mazel tov department: **Seth Goldstein** was elected a fellow of the American Society of Mechanical Engineers last year—congratulations! . . . **Tom Geers** writes that he is leaving his current position as head of Lockheed's Applied Mechanics Laboratory in Palo Alto to be the chairman of mechanical engineering at the University of Colorado in Boulder—congratulations!

I took advantage of an alumni association telethon to get in touch with some classmates and learn what they are doing. On calling **Paul Hogle**'s home, I was very much shaken to learn that Paul was killed in a automobile crash last May 1.

As you may know, **Clarke Swannack** died last year in an airplane accident in a remote section of Conejos County, Colo. The wreckage was only found a few months ago. After M.I.T. Clarke went to Oxford, Carnegie Tech and Carnegie-Mellon, getting a Ph.D. in nuclear physics in 1970. For the last ten years he worked at Los Alamos on particle beam technology. Clarke was a remarkably talented person. He was an acccomplished pianist, a fine pilot, a nationally ranked bike rider and almost entered the astronaut program. A great loss.

We all liked Paul and Clarke very much and their accidental deaths cast a pall over the evening. We all send our deepest sympathies to the Hogle and Swannack familes.

All the usual suspects were present at the bank of phones to persuade classmates to attend our 25th reunion in Cambridge next June. Between calls, **Ed Sonn** told me about life at Data Terminal, Inc. Ed has been involved in what he called "low end product" procurement from manufacturers in Japan. That has meant 19 trips to Ise, a pleasant city about 150 miles south of Tokyo, in the last three years. He works out the specifications and some of the design here, then scrunches into a business class seat for a day and negotiates with a Japanese firm for production.

Martin Falxa looked quite content. He has come out of a major life upheaval intact. A couple of years ago he was divorced and has since married Betty Falxa, a naturalist for the Audobon Society. He met her while taking an astronomy course—Betty was the teacher. At the same time, Martin left Polaroid and went to Professional Data Analysis, Inc. in Natick, Mass., where he is happily selling intermediate size computer systems to intermediate size firms.

Recipients of my phone calls were relieved that I wasn't trying to get contributions (that's the next call) and were glad to talk about their lives and families. **Doug Johnson,** who lives in Cleveland, is an assistant vice-president at Merrill Lynch and will be celebrating his 20th wedding anniversary next June. The Johnsons have three children: Bill, who is graduating from high school; Debby, a junior; and Phil, a freshman. . . . **Charlie Ruttenberg** told me all about his family. His older daughter, Miriam, will be going to Hampshire College in Amherst, Mass. in September 1986. She is deferring college entry for a year so she can go to Israel to work at a kibbutz. I gather more and more colleges are letting freshman take a year off before resuming the academic grind. It seems like a good idea. Charlie's younger daughter, Judy, is a junior in high school, and Charlie thinks she will probably take a year in Israel, too. Charlie continues life as a lawyer for the National Labor Relations Bureau in Washington and lives in Silver Spring, Md.

Don Straffin, who lives in the lovely town of Bedford, N.H. told me all about his kids, but I can't read my own writing and therefore can't give you the names. In any event his eldest is already married and has two children. That makes Don a very young grandfather. His youngest child is 15 and an avid baseball player. In between are two college students, one at Keene State and the other at DePaul. Sorry about my handwriting, Don.

Sam Williamson is professor of physics, physiology, and biophysics at New York University where he is studying neuromagnetism. Apparently he puts sensors all around the head and, using high class math, can develop a three dimensional picture of the magnetic fields within.

Some shorter notes. **David Sabo** is a research associate at the Amoco Research Center in Naperville, Ill. . . . **Bob Lewis,** who is associate director of the Army Materials and Mechanics Research Center in Watertown, Mass., is now a member of the Senior Executive Service, a "cadre of extraordinarily competent and dedicated people who are accountable for government programs." Congratulations! Except for a year off at Union Carbide, Bob has been working for the army since getting his Ph.D. (course X) in 1970. The Lewises have two girls, Jacqueline and Kristin.

You probably have been inundated with mailings about reunion plans by now. For the record here are the plans as of midsummer. On Thursday, June 5, there will be a couple of class parties surrounding Tech Night at the Pops—a pre-concert buffet at Symphony Hall and a post-concert gathering at the M.I.T. boat house for liqueurs and ice cream. Friday, June 6, is mostly M.I.T. functions, but a class dinner dance is scheduled that evening at the Boston Museum of Fine Arts. On Saturday, there will be a clambake on Thomson's Island in Boston Harbor. At night there will be a cocktail party and individual living group parties. Finally, on Sunday there will be a brunch in the spiffy new M.I.T. Arts and Media center. **Joe Harrington** brought a copy of our yearbook to the telethon, and I noticed that the rear endpapers had an air view of Boston in 1961. It is truly remarkable how much Boston and Cambridge have changed over the years. Come back and check it out for yourself. Show your spouse and kids where you suffered for four years. Make your reservation. That's an order!

I hope you all have a pleasant holiday season and the new year brings you contentment and happiness.—**Andrew Braun**, Secretary, 464 Heath St., Chestnut Hill, MA 02167

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Two of our classmates have been elected to the National Academy of Engineering: **Donald C. Fraser** and **Erich P. Ippen**. Don, who is vice-president, technical operations, Charles Stark Draper Laboratory in Cambridge, was cited for "unique engineering contributions that brought digital control technology to practice and are leading to fault-tolerant systems in the future." Erich, who is professor of electrical engineering at M.I.T., was cited for "pioneering contributions to nonlinear optics in optical wave guides and ultrashort-optical-pulse-generation techniques."

Lloyd Armstrong writes that he is now chairman of the department of physics and astronomy at Johns Hopkins University and chairman of the National Research Council Committee on Atomic and Molecular Sciences. . . . **Alan W. Carlson** has moved from vice-president to president of M/A-Com Millimeter Products, Inc. in Burlington, Mass. . . . **Seth R. Goldstein** has been named a Fellow of the American Society of Mechanical Engineers. Seth is chief, mechanical engineering section of the National Institutes of Health. . . . I received a nice letter from **Art Sandberg**, who 15 years ago gave up aerospace engineering for an MBA and a career in investment management. He has now joined a new firm, Dawson-Henry Capital Management, Inc. as president and chief investment officer. . . . A news release from governor's office announces the appointment of **David N. Wormley** to the Massachusetts Technology Developmeent Corp., an independent public agency which provides venture capital for technology-based companies.—**John E. Prussing**, Secretary, 2106 Grange Dr., Urbana, IL 61801

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I have a newsy note from **Dale Miller**, who tells us his new phone number (he has not moved) is (415) 449-0487. Dale is in his 11th year at Lawrence Livermore Lab, in the E.E. Research Division, directing projects in thin films and advanced materials. Sons Sven, 17, and Hans, 14, enjoy visiting his wife, Kari's family in Norway, Switzerland and Germany. . . . **Steve Kaufman** has been promoted to president and COO of Arrow Electronics of Greenwich, Conn. . . . U.S. Representative **Don Ritter**, who graduated in our class, and later received the Sc.D. in metallurgy from the 'Tute, is vice-chair of a Republican high-tech task force, and a member of the House Committee on Energy and Commerce. . . . A fellowship, funded by $250,000, has been established for graduate study in economics at M.I.T. by **John Castle**, who is President and C.E.O. of Donaldson, Lufkin & Jenrette, a N.Y. investment company. John is also chairman of the board at N.Y. Medical College, Valhalla, N.Y., and a director of Equitable Life Assurance Society of the U.S.

As of late July yours truly has a new job, in fact a bit of a new career, as manager of engineering at Columbia Data Products, a manufacturer of micro-computers in Columbia, Md. The Law being a jealous mistress, I hope she won't be too bent out of shape by my sojourn in technology and management. My son Gary, 15, is following somewhat in my footsteps, participating in last August's anti-nuclear protests on the 40th anniversary of the Hiroshima and Nagasaki bombings. And my wife, Linda Marsden, has established a consulting practice in organizational effectiveness.—**Phil Marcus**, Secretary, 2617 Guilford Ave., Baltimore, MD 21218; (301) 889-3890

64

This is another airplane seat column. I'm on my weekly commute to the great Midwest. This morning the pain of getting up for a 7 a.m. flight from Washington National Airport was more than made up for by an absolutely spectacular sunrise coming up behind the Capitol and all the monuments. After just under two months, I think I've become a cheerleader for D.C. Come visit—and if you can't do that, write—please!

One of our classmates who did just that is **Russ Norris**. He and his wife Dixie are moving from Hollidaysburg, Pa., to Columbia, S.C. Russ will be the new executive minister of the South Carolina Christian Action Council which he describes as "sort of the equivalent of the state council of churches." Dixie is the new business manager at the Lutheran Theological Southern Seminary. Their daughter Claire is a junior this fall at Johns Hopkins in Baltimore, majoring in chemical engineering. "At least one member of the family is still in engineering," says Russ. The Norrises extend an invitation to all to write or visit—1517 Whippoorwill Drive, West Columbia, SC 29169.

The second item this month is an Alumni Fund note from **Shingo Nishikawa**. He writes that he has been travelling by air more than 100K miles per year, setting up joint ventures and selling AT&T network products. Shingo's home base is Basking Ridge, N.J. but he notes that his favorite past-times in between business meetings are drinking in Seoul and bicycling outside of Amsterdam. Shingo's academic experiences at M.I.T. are various. He entered in 1959 in the VI-A program and received a dual S.B./S.M. in February, 1965. Subsequently, he was in the Sloan Fellows Program in 1979. Shingo is curious as to whether he's a member of '63, '64, '65 or '79. Well, since the *Alumni Register* says '64, and since anyone who travels, drinks and bicycles can't be all bad, let's make it '64.

Our next item is a press release from the California Polytechnic State University at San Luis Obispo—or as the results summaries in the sports pages say, Cal Poly SLO. **Harvey Greenwald**, a

R. Norris, '64

protessor in the mathematics department, was recognized as one of three Distinguished Teachers for 1984-1985. The honors include a certificate and a cash award, and are based on nominations from the campus community, in depth interviews and classroom visits by the selection committee. In addition to his M.I.T. degree, Harvey has earned a master's and doctorate from Washington University in St. Louis. His previous teaching experience includes positions at Washington Univ. and Univ. of Calif. Irvine. Oh, how I wish that I had known that there was a future distinguished mathematics teacher in our class when I was struggling to get my D in 18.20.

The final item concerns classmate **Tony England** who is riding the space shuttle *Challenger* as a mission specialist, as I write this column. After receiving his S.B. and S.M. in geology and geophysics, he began work toward a Ph.D. In 1967 he was selected for astronaut training; his Ph.D. was awarded in 1979. One observation: I admire the hard work and perseverance and patience shown by people in the astronaut program such as Tony. Sticking with it for 18 years from selection to flying is incredibly admirable.

I hope your holiday season is a pleasant one and that 1986 brings you all good fortune. Please write, call, visit, or whatever.—**Joe Kasper**, Secretary, 3807 Benton St., N.W., Washington, DC 20007

65

Well the reunion has come and gone, and I have to admit that Anne's and my schedule kept us from attending. A side effect is that I don't know whether I was re-elected secretary or not. That uncertainty (and the everpresent disease—sloth) caused me to skip last month's column. But the envelopes from the Alumni Association keep rolling in, so I figured I'd better make this deadline. If you are out there reading this column and you know that you are the secretary of the Class of 1965 (and I'm not) please get in touch with me.

Steve Rosenberg also missed the reunion and, overcome with guilt at being out of touch, sent me a long letter about his recent activities. Steve is president of International Service Consultants, Inc. of Cambridge. Steve's company provides government liaison and personal security for a number of entertainers and groups (Phil Collins, Robert Plant, Julian Lennon, the Firm, U2) as well as marketing and management consulting and corporate investigative services for a number of Fortune 500 companies. Steve's firm also owns electro-mechanical and electronics sales, service and engineering companies (Cambridge Electric Motor Service and C.E.M. Systems) that are now located in Kendall Square near M.I.T. Steve also noted that he is now president of the Institute of Public Service Management, a non-profit corporation dedicated to improving the quality of management and professionalism in law enforcement and government. Steve has been on the board of the Institute since its founding in 1967. Steve and wife Mary Ann (formerly of the Course VI graduate office) live in Wayland with their four-year-old daughter Lynne.

Jim Sprinkle sent a note on one of the ubiquitous Fund envelopes reporting that it has been a fairly quiet year in Austin. Jim says he got "put on more committees" and jointly published a lab manual in paleobiology. Gloria (G.K.) has been lobbying for women's issues during the Texas legislative session, and the kids are rapidly growing up (8 and 11 now). . . . **Dave Curtis** writes that June, 1985 marked his third year in the Pittsburgh area where he heads the government technical staff at the U.S. Department of Energy Bettis Laboratory. Bettis is the lab that supports the Naval Nuclear Propulsion program. Dave says that he has gotten to know some Pittsburgh area alumni by participating in telethons, but wonders where all the others are. . . . **Dave Carrier** writes that a closely-guarded secret of the American Society of Civil Engineers is that he was one of the recipients of the 1984 Thomas A. Middlebrooks Award for Geotechnical Engineering. Dave says that he was also pleased to see that two M.I.T. track buddies published articles a few weeks apart: Jim Flink, '64, in *American Scientist*, and **Rob Wesson** in *Scientific American*.

On July 4, Anne and I went down to Dennis on Cape Cod to attend the housewarming of Ann and **Ed Burke**'s summer retreat. Ed is still in charge of Data General's laboratory in North Carolina, but Ann and the kids (Jill and Andy) come up for the summer and Ed travels north enough to spend a fair number of weekends with them. **Terry Dorschner** and family were among the attendees at the housewarming, and Ed mentioned that he had recently run into **Bill Weisgerber** who is running a small electromechanical controls company in Florida.

Lee Ann and **Richard Schwarz** wrote to announce the birth of Steven C. on May 29, 1984. Steven is their third son and fourth child. Richard also said that he had run into **Bill Freed** at a professional meeting in Chicago. Bill is working for Rohm and Haas, was married in 1972, and now has three children. . . . **Mary Coffey** is still working as a senior scientist for Bechtel's research and engineering group. She reports that she is doing a lot of hiking in the East Bay area and slowly getting to see more of California. . . . **Cary Shaw** has been named manager of management science at Pitney Bowes in Stamford, Conn. Cary joined Pitney Bowes in 1979 and had been senior operations research analyst before his promotion. . . . **Woody Vandever** has joined InterConsult of Cambridge as director of consulting services. InterConsult is a market research and consulting firm in the area of electronic publishing. Woody had been an independent consultant and vice-president for engineering of Higher Order Software, Inc. before joining InterConsult.

Richard Ayers has been elected president and chief operating officer of Stanley Works of New Britain, Conn. He had been executive vice-president before his promotion, and has been with Stanley since 1972. . . . **John Kassakian**, still a professor of electrical engineering at M.I.T., has been elected a director of Sheldahl, Inc. of Northfield, Minn.

You folks don't forget to write now and tell me if I'm still allowed to sign as. . . . **Steve Lipner**, Secretary, 6 Midland Rd., Wellesley, MA 02181

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Becky Donnelan and her husband Nathan J. Karch have joined the club of proud parents with the birth of Casey Asher Padraig Donnellan Karch in March. Becky is back part-time at the Justice Department with young Casey in tow. . . . **Alfredo Sadun** has moved out to San Marino, Calif. . . . **Ronald Conterio** is based in Blue Hill, Maine, overseeing EBS' relationships with contractor customers and the quoting and expediting of home and commercial construction projects west of Ellsworth. . . . **Dean L. Melnyk** completed his Ph.D. at SUNY, Buffalo. He is now back at Buffalo after getting his M.D. and being a research associate at Albert Einstein College of Medicine. Dean will be a resident at Strong Memorial Hospital, Rochester, N.Y.

Marc V. Gorenstein wrote with a brief run-

down of his life since he left the 'Tute. As he puts it "the big news, which prompts this letter, is that last fall I got married. Marian Novick, my wife, is from New York and is a graduate of Cornell University. She is a writer: her first novel, *At Her Age*, is being published by Charles Scribner's Sons; it will appear this fall. Currently, we are renting an apartment in Belmont while shopping for a house in the Boston area." As to what else he has done, after graduation he headed out to the University of California at Berkeley with the idea of earning a doctorate in elementary particle physics. His plans changed somewhat; he did get his Ph.D. (in 1978), but it was in astrophysics instead. Missing the Institute more than he would have guessed or at least Boston anyway, his first job was back at M.I.T. in the earth and planetary sciences department (as it was known then). The job came complete with an office that had a fourth floor view of the Charles. In 1983 he left M.I.T. and moved down the river to pursue his research interest in radioastronomy as a member of Harvard's Center for Astrophysics.

I saw **Carliss Baldwin** and her husband, Randy Hawthorne, '71, recently. Carliss continues to enjoy teaching at the Harvard Business School, where by all reports she is doing a great job. Randy and Carliss had a darling baby girl the end of last year. Randy continues successfully in the syndication and financing business with Boston Financial Technical Group, where he has been since he finished business school.

Paul Karger has "lots of news for the class notes! I married Carol-Lynn Covitt on April 3. She attended Wellesley ('63-'65), graduated from Berkeley in '67 and received her master's from the Harvard Graduate School of Education in '69. My best man was Steve Lipner, secretary of '65. My new father-in-law is Arthur Covitt, '41, and my new brother-in-law is Marc Covitt, '71. Carol-Lynn and I are living in Cambridge, England, while I'm working on my Ph.D. in the computer laboratory, University of Cambridge. DEC is sponsoring my Ph.D. and Carol-Lynn is on leave of absence from Computervision."

Phil Kerelee, 1007 130th SW #A304, Everett, WA 98204 writes to say that he found a '72 class ring near Kresge three or four years ago with a not-entirely-legible inscription. The first name is Louis but the last is unknown.

Conor Reilly recently became a partner in the New York law firm of LeBoeuf, Lamb, Leiby and MacRae. Congratulations! . . . **Duncan Allen** has become president of the M.I.T. Club of Washington. . . . **Gail Thurmond** is a mother again. She had twin girls in July. Son Robbie now has two sisters, Laura Robin and Sarah Wendi. The family also has a new house to accomodate their growing size.

That's it on news this month. I have been doing a lot of traveling to the west coast this summer as I have been working on several project financings for Kidder Peabody and Co. Inc. the deals I have been putting together have been fun, and each one has involved an alternative energy project. Send Dick or me your news.—Secretaries: **Wendy Elaine Erb**, 531 Main St., Apt. 714, New York, NY 10044; **Dick Fletcher**, 135 West St., Braintree, MA 02184

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A couple of letters brightened my mailbox recently. **Chris Tavares** wrote to say that he is moving to Hudson, Mass., in August. He is transferring to the home office of Stratus Computer to be with the customer service "swat team." All Boston-based buddies are invited to find him. . . . **Forrest David Milder** also wrote; he got his masters from M.I.T. in economics in 1974, followed by a law degree three years later at Harvard. He has been practicing in Boston ever since, this year becoming a partner at Brown, Rudnick, Freed & Gesmer specializing in Federal taxation. He married Sara Packard (Wellesley '75) in her graduation year, producing since two children, Stephen ('04) and Elinor ('06). Thank you for the kind note, Mr. Milder. . . . **Nick Loter** passes along that he is at present happily entrenched in San Diego as a senior staff scientist at Maxwell Laboratories. . . . **Howard Hutchins**, D.V.M. has recently opened a veterinary practice at Central Animal Hospital, 109 Central St., Stoneham, Mass., specializing in small animals. He is glad to see former classmates and graduates of M.I.T. who live in the area.

Tony Scandora, the only classmate whom I ever see, stopped by with Kathi in June to visit. We are this week celebrating both couples' fifth anniversaries. Tony has finally left SAI after a number of years and is working at Argonne Laboratories in Joliet, Ill., or thereabouts.

Ruth and I expect the kids to start school in a week, and we are hurriedly finishing their rooms before then. The outside of our home is about halfway done, the stone work is finished, and the stucco as fast as our Bulgarian's little hands will move. Bowling starts in two weeks, and Alpha's progress is startling for a mom 'n' pop company. Write!!!—**Robert M.O. Sutton, Sr.**, Secretary, "Chapel Hill," 1302 Churchill Ct., Marshall, VA 22115

75

Who said lightning doen't strike in the same place twice? Class secretary **Jennifer Gordon** is taking a well-deserved August vacation in Europe allowing me (**Richard McCarthy**) one last chance at literary fame. ("This is the silliest thing that ever I heard"—*A Midsummer Night's Dream)*

Allen Hart writes that he is working for Grumman-CTEC in McLean, Va. His second child, Kyle David, was born Sept. 5, 1983. . . . **Allen Razdow** is presently vice-president of technology at High Order Software in Cambridge, Mass. . . . **Margo Levine** has been named a principal at Temple, Barker & Sloane in Lexington, Mass. Congratulations, Margo. . . . **Charles Fendrock** continues raking leaves at his new house. . . . **Alexander Jones** has accepted the position of director of minority and Third World affairs for the Church of Scientology International's office in Washington, D.C. . . . **Joseph Sacco** writes that he has just accepted a position as assistant professor of medicine in the division of cardiology, Albany Medical College "after MUCH deliberation over the benefits of private practice versus academic medicine." He and Gail expect their first child around Sept. 1 (Labor Day?). . . . **Benjamin Hauptman** was recently elected partner in the patent law firm of Lowe, King, Price & Becker in Crystal City, Va. He and his wife were expecting their second child in July. They already have a daughter, Ariel, age 2.

Progress on the Class of 1975 Scholarship Fund is going quite well. I'll let Jennifer give you the final stats for fiscal 1985. Please tell Jennifer what you're up to—we'd all like to know. Start getting ready for 1986!—**Richard McCarthy** for **Jennifer Gordon**, Secretary, 18 Montgomery Pl., Brooklyn, NY 11215

79

It is my sad duty to report the death of **David Erwin Miller** on July 1, 1985. At the time of his death, David was an F-4 navigator with the California Air National Guard at Edwards AFB, and had attained the rank of lieutenant. Our sincerest sympathies go to his wife, Debby Ward, and the Miller family.

Susan Silverstein writes, "My community lawyer fellowship (a two-year term) is now up at Southern Tier Legal Services. I will be moving on to a staff attorney position at Legal Assistance of the Finger Lakes, in Geneva, NY. Geneva is twice as big as Bath, where I live now (pop. 10,000 vs. 5,000). However, I will be moving to Penn Yan, a small town halfway between Bath and Geneva, nestled in the Finger Lakes. At my new job, I will continue to focus on rural housing issues." . . . **Sandra Viarengo** is currently employed by Intel Corp. as a group manager for a semiconductor fabrication plant. She writes, "The environment is hectic and technology changes are so rapid that I'm never bored!" . . . **Scott MacFarlan** is a metropolitan area director managing seven branches of NCNB National Bank of North Carolina in Charlotte. He invites everyone to come sailing if they are in town.

Rob Steidlitz called today to tell me that he is here at Mobil for the summer, working in the supply and distribution department. Rob is halfway through the M.B.A. program at Wharton. Before that, he was a field engineer with DuPont, spending a year in Columbia, S.C., two years in Delaware (in the same plant as **Eileen Mannix**), and 1 and a half years in Augusta, Ga. . . . **Keith Reid** is "presently serving as New England coordinator for a Christian organization called Family Health Education Service, bringing new life to those in darkness through the 'Bible Story,' 'Bible Reference Library,' and 'You and Your Health.' **Cornell Pearcy**, where are you?" . . . A friend of mine met **Gary Isaacs** recently and, upon discovering that he went to M.I.T., asked him if he knew me (answer: affirmative). She proved to be a very good spy (for a non-M.I.T. graduate!) and told me that Gary used to work for TRW, is now getting his M.B.A. at UCLA, and was working here in New York for First Boston during the summer.

Martin Aboitiz is now president of BUN, S.A. in Buenos Aires, and is married with two children. He says, "All things considered, I'd rather be here than in the Student Center Library!" . . . Your faithful secretary will be leaving in four days for two weeks in our northern neighbor, Canada. It should be a nice restful vacation, although probably more driving than my delicate constitution would prefer. Still, two weeks away from alarm clocks, bosses, subordinates, and ringing telephones should seem like heaven! Hope all is well with you.—**Sharon Lowenheim**, Secretary, 303 E. 83 St., Apt. 24F, New York, NY 10028

80

Not too much news this month. I hope this is just a temporary condition and that you are all out there writing up news for the 1986 issues of *Tech Review*.

Emerson Yearwood writes that after a short stint with the Bronx Legal Services, he will be enrolling in Yale's School of Organization and Management seeking a master's degree in public and private management. . . . **Mark Lehrer** is also in graduate school, pursuing a Ph.D. in German at UC Berkeley.

Mary Rorabaugh graduated from Sloan in February 1984 and is working for VLSI Technology Inc. (VTI) in San Jose, Calif., as a senior financial analyst. . . . **Steve Berez** moved back to Pittsburgh after graduating from Stanford Business School in June 1984 to work for the not-so-small family business, Action Industries. . . . **Barry Star,** on the other hand, joined Steve's brother Joel ('76) at Infocom in Cambridge. He is a Stanford classmate of Steve's and is now doing product marketing of some sort. . . . **Tim McManus** is "pulling down the big bucks" (my words, not his) doing independent software consulting for Honeywell Underseas System Division (something like that) in Minneapolis. He graduated from Sloan in June 1984 but prefers not to have people know that (so don't say anything). He also is part owner of Pow-wow Campground in Galesville, Wisc.

Pat Latterell has been working for Syntex in corporate development since he graduated from Stanford Business School in 1983. . . . **Brian King** lives in Cambridge and is, I believe, doing programming somewhere.

Family news came from **Joe Bernier** and **Debbie (Goldberg) Bernier**. Joe writes that both of them are enjoying life working for Harris Semi-

conductor in Florida, where he is working on reliability studies of military ICs and Debbie is developing software design tools for circuit designers. He continued: "The biggest thing that's happened to us recently is the birth of our son Benjamin David (hopefully class of '07) on April 15, 1985." . . . **Brian Clouse** and Martha also had their first child, Matthew, on June 21. Brian is a design engineer with GE Aircraft Engine in Lynn, Mass. He and Martha are enjoying home ownership (as well as parenthood)—they bought a house in Saugus. Congratulations to all new parents!

Ralph Vinciguerra wrote something that I can't really interpret, so I'll just leave it up to each of you: "The elusive triple beaver is now in sight! Meanwhile, sailing a lot and driving my new red Fiero (can you say "debt"?) keeps me busy. I stepped down as director of the Thristy Ear Pub to be its first 'consultant' (employee discount). 'Rust never sleeps.' " Got that? I think it means he's soon to get his third M.I.T. degree . . . but I don't know about that last line.

By the time you read this I will have started a new job as an associate at Index Systems in Cambridge, which I am really looking forward to. Since Index is in Cambridge Center (alias Kendall Square) I'll really be back on the stomping grounds, which could be fun . . . right? And I'll be really close to the Alumni Center to pick up all your cards and letters. (So keep them coming!) Have a great holiday season! 'Til next month.—**Kate Mulroney**, Secretary, 10 Arizona Terrace #3, Arlington, MA 02174

83

Erik Hjerpe has been promoted from ensign. I would love to tell you what he currently is, but he only said a promotion. Erik is assistant public works officer for South Weymouth Naval Air Station. . . . **Cynthia Bedell** was not only promoted but decorated simultaneously. She was awarded the U.S. Army Commendation Medal at Fort Lewis, Wash. The medal is awarded to those who demonstrate outstanding achievement and performance on behalf of the army. . . . **Yueh Chuang** is currently an environmental engineer with Martin Marietta Environmental Systems in Columbia, Md. He is doing his best to see that certain manuacturing processes are a bit more innocuous to the environment.

Mike Lopez called to say that news recently reported about him in our column was incorrect. He is sending an updated letter on his current activities. . . . As for myself, well, the summer has just flown by. I spent the entire summer at Ramapo College with Garth Gehlbach, '85, and Albert Bashawaty, '84. Garth was working for Philips Electronics, and Al just started a job with Morgan Guaranty. I didn't have to go to many classes this summer, so spent some time in New York. I traveled to La Chaux de Fonds, Switzerland to compete in one of the Swiss track meets. I had a lot of fun. I will be leaving next week for my final class with IBM. It is their sort of finishing school. Who knows, I might make it out of this training program yet. I hope all of you have a nice holiday. Please keep the letters coming.—**John E. De Rubeis**, Secretary, 47 Gillette Ave., Sayville, NY 11782

84

My profuse and sincere apologies for missing the deadlines for the last several issues. You guys deserve better service than that. There is no reasonable excuse for not executing my duty—that is to write a hopefully interesting and witty class notes column each and every issue. So, rather than explaining or obfuscating the nonexistence of this column in previous issues, I will devote my energies to producing the high quality column you so fully deserve.

Intelligence sources report that **John "Hokey" Holcomb**, former ring committee chairperson, has been assigned as 4th Division Officer aboard the battleship, *USS New Jersey*, homeported in Long Beach, Calif. It was also reported that **Albert Perez** has been commissioned a second lieutenant in the U.S. Air Force after graduating from Officer Training School at Lackland Air Force Base, Texas, and is now assigned at Auburn University, Ala.

Serving a different sort of combat duty, **Tomo Hasegawa** finished his fifth year at M.I.T. (6A) and, more importantly, his thesis. I learned that Tomo lived directly above me in Ashdown when I received an invitation to the "I Wanna Rock Party" at the "world-renowned Tomo & Carl Ranch." Aside from throwing parties, Tomo took time to play A League intramural table tennis. Another key member on this outstanding team was **Albert** ("I play like an 1800 player when I don't miss my loops") **Tam**, who is finishing his master's degree in mechanical engineering. Because of the inspirational leadership of its captain (**Peter Tu**), this team finished second. The hard-fought final was against a team in part comprised of **Rayo Kotwal** and **Patrick Tan**, both also in graduate school at M.I.T.

Digging through months-old mail, I found the following letters of interest. **Jonathan Grad** informs us that he is a Sherman Clark Teaching Fellow in the department of chemistry at the University of Rochester, where his free time is spent exploring the countryside on his bicycle and earning badges for 100 mile rides.

Charlie Marge writes that he is "living in Tang now as a grad student." He is pursuing simultaneous master's degrees in operations research and management, and expects to graduate in June, 1986. He further mentions: "I'm still playing with the M.I.T. Concert Band, the M.I.T. Festival Jazz Ensemble, and the M.I.T. Chamber Music Society. I'm also the student manager of the 1985 New England Intercollegiate Band. Needless to say, I'm quite busy!" Charlie also had information for us about **Kirk Mousley** ("returned to M.I.T. this spring after finishing up his engineering internship with G.E. Space in Valley Forge, Pa. . . . will get his master's and bachelor's in 6-1 in June and has already accepted a job with Rabbit Software in Malvern, Pa.") and **Rob Horwitz** who is "working in the Pacific Northwest for Microsoft."

Maralene Downs, writing on Sheraton Hotel stationary, chastises me regarding misinformation in a previous column: "I am not in West Ispich, N.J. West Ispich is in New York! (I'm not there either.)" Maralene, at the time, was in Los Angeles "on business and having a blast" (I suspect the emphasis was more on having a blast). Prior to that, Ms. Downs was in San Francisco "on business," managing to squeeze in time to visit **Ira Leventhal**, who is also working for HP in Santa Clara. Her busy itinerary even allowed her to have lunch with **Louis Vintro**, who is working on his Ph.D. in physics at Stanford. Business then forced Maralene to go to the Napa and Sonoma Valleys with **Beverly Gates** and John Gonzales, '83. In New York, Maralene talked with **Darrin Taylor**, who is a graduate student in Course 6 at M.I.T. She also talked with **Rich Williamson**, who is working for Bell Labs (6A). Maralene's future plans include "bopping in on" **Lance Parker**, **Bob Teachey**, and **Fred Allan** in Philly, no doubt "on business."

Lastly but certainly not leastly, I present a very old letter (dated in January) from our very own class president, Ms. **Diane Peterson**. Selected comments follow. "Since I read **Dennis**'s (**Sacha**) slanderous remarks about me in *Tech Review*, I took it as a hint to correspond myself. Yes, I work at Rocketdyne, and yes, I sit at a console during shuttle launches to monitor engine data. I even get sent on business trips to NASA Marshall Space Flight Center in Huntsville, Ala. . . . Meanwhile, in LA, **Vivian Wang** and I have been doing a lot: concerts, museums, studios, *The Tonight Show*, and are off to Palm Springs next weekend. I am involved in the Valley Alumnae Chapter of Alpha Phi and went to a fancy Alpha Phi Christmas Party with **Miriam Lachman** and **Rob Pokelwaldt**. Miriam and Rob and Vivian all work for Hughes. Vivian has started classes at USC. . . . Miriam is returning to M.I.T. . . . to complete her S.M. for her EIP program. I plan to start classes in the fall. . . . **Mark (Miles)** is at Hughes also, but is returning to M.I.T. next term. **Ed Monuki** is active in a new band out here, playing the college circuit. . . . Congratulations to **Eric Brandt** and Darlene from BCM on their engagement, and to **Brian Manion** and Lizzy (Wellesley) on their marriage. **Dan Battista** is in LA working for Hughes." Diane closes her letter by wishing **Kathleen Harragan** "Happy Birthday" (January 16) and noting that Kathleen is working for IBM on Wall Street and "spends any free weekends in Boston visiting her younger man."

In closing, I remind you to write early and write often.—**Peter Tu**, Secretary, 259 Summer St., Somerville, MA 02143

85

Greetings dear classmates! I'll be returning to Boston soon and look forward to getting together with those of you who have elected to remain back east. Last I heard **Dave Libby** was in the Boston area, and in a moment of insanity has considered working for Hahvahd—Dave where is your loyalty!? **Danielle Sherwood**, on the other hand is working in the M.I.T. Alumni Center. . . . so don't by shy about contacting the alumni office and leaving your current address or getting information about finding or founding a local M.I.T. club.

Inge Gedo is now somewhere between Denver and San Angelo, Tex. preparing for her air force assignment in West Berlin. She tells me that **Lynne Harth** will be replacing her as the New York/New Jersey contact person. Lynne spent her summer in Los Angeles and is currently working in the New York City area. Bonnie Kellerman, '72, needs educational counselors for several areas across the U.S. If you're interested contact the Educational Council Office, M.I.T., Room 4-240, (617) 253-3354

Alex Menchaca has delayed going to Law school at Loyola for a year to "play in Europe" for a couple of months. . . . **Larry Shapiro** has been traveling also, all over the U.S. as part of his job. Surprisingly, I haven't heard much about any Bakerites lately, at least not any '85 Bakerites. however, many Class of '84 members are living in the valley area and are causing just as much trouble as before. Libby Patterson is living nearby in Union City while finishing her VI-A with HP and **Paul Sohl** has begun grad school at Stanford as have several other classmates.

Still more classmates have become engaged. **Kathy Geary** and Eric Balles (currently a grad student at M.I.T.) have decided to take the vows of holy matrimony as have two classmates, **Chris Woelfel** and **Tom St. Louis**. . . . Also, **Dan Curran** has been engaged to Stephanie Dodge, '86, for several months now. . . . **Pauline Liu** is working in Boston. . . . **Diane "Muffy" Hess** has accepted a job in New York.

Finally, the update on the Theta Chi contingent. **Tom Boucher** is working for the navy in sunny San Diego. . . . **Clark Custer** is in nearby Los Angeles working for TRW while enjoying his new car, so I'm told. . . . In June both **Mike Jassowski** and **Mark Hennenberger** were married. Mike is attending grad school at RPI, and Mark is working for the navy in Washington, D.C. . . . To the best of my knowledge, **Andy Weiss** is still single. We've been checking out the sites of San Fran, as have been many other classmates in the Bay area. . . . **Paul Washburn** is working for Corning in New York State, and **Lance Adams** is attending University of Texas at Austin. . . . **Chuck Lane** is either in Texas or working for TRW in Cleveland. . . . **Scott Drane** is still at large; his whereabouts remain unknown so to speak. Happy Holidays!—**Stephanie Scheidler**, Secretary, 4792 Raspberry Pl., San Jose, CA 95429

I CIVIL ENGINEERING

S. Bruce Smart, Jr., S.M.'47, formerly chairman and CEO of the Continental Group, Inc., has been confirmed by the Senate to be undersecretary of commerce for international trade. In his confirmation hearing, Smart listed three concerns: the "huge and growing" trade deficit of the U.S., the high value of the dollar, and the failure of foreign nations to give U.S. good access to their markets. Smart opposes "the current drift toward worldwide protectionism," he told the Senate, but he promised to search for policies "that permit industries affected by imports to respond to new competition without crippling our industrial base."

Professor **David H. Marks,** who came to M.I.T. in 1969 as assistant professor, now heads the department, succeeding Professor **Joseph M. Sussman,** Ph.D.'68. Marks is a specialist on water quality and water resources, a graduate of Cornell and Johns Hopkins (Ph.D. 1969). Sussman has returned to full-time teaching and research, in accordance with plans announced a year ago.

Robert N. Storer, Ph.D.'68, formerly head of its Shore Facilities Department, has been selected technical director of the Naval Civil Engineering Laboratory, Port Hueneme, Calif., the U.S. Navy's principal center for facilities research and development. . . . **Shih-Ying Lee,** S.M.'43, executive vice-president at Setra Systems, Inc., Acton, Mass., has been elected to the National Academy of Engineering to recognize his innovation of instrumentation and its successful commercialization.

Two deaths have been reported by the Alumni Association, with no further details available: **Leon A. Yacoubian,** S.M.'55, of Damascus, Syria, in an accident in Paris in April 1985; and **William G. Hamlin,** S.M.'42, of Glenshaw, Penn., on June 20, 1985.

II MECHANICAL ENGINEEERING

Professors **Nathan H. Cook,** '50, **Henry M. Paynter,** '44, and **Warren M. Rohsenow** retired from full-time teaching and research last June 30. Cook has moved from Cambridge to his home on Cape Cod, Paynter is this year teaching at Arizona State, and Rohsenow is continuing part-time work in the department at M.I.T. . . . Professor Cook is widely known in the profession for his work in machines and manufacturing and among M.I.T. undergraduates and alumni for his 15 years' service (with Mrs. Cook) as master of New House. Cook was named assistant professor in 1953, two years before he completed his Sc.D. in the department, and he rose to become professor in 1965. He was for many years director of the department's Materials Processing Laboratory, and he has recently been associated with the Laboratory for Manufacturing and Productivity. . . . Paynter is a broad-based engineer who has worked recently in the department's Systems Dynamics and Control Group. His degrees, all from M.I.T., are in civil engineering, mathematics, and hydroelectric engineering, and his major research has been in power system dynamics, process control, computer simulation, manufacturing technology, and system engineering. He holds the Oldenburger Medal (1979) of ASME for "meritorious contributions to the field of automatic control," and he's also been honored with the Herschel Prize of BSCE and the joint engineering societies' Alfred Noble Prize. . . . Rohsenow came to M.I.T. after World-War-II service on the gas turbine project of the Navy Engineering Experimental Station in Annapolis; he studied at Northwestern and Yale (D.Eng. 1944) before the war. At M.I.T. he was for many years in charge of the Heat Transfer Laboratory, and he has written papers on heat transfer, condensation, conduction, temperature measurement, heat exchangers, and gas turbines, while his consulting work has involved the same fields applied to equipment and process design.

III MATERIALS SCIENCE AND ENGINEERING

Bernhardt J. Wuensch, '55, now holds the TDK Professorship in the department at M.I.T., established by a $1 million grant from Japan's TDK Corp., the world's largest maker of magentic recording tapes and ferrite products. Wuensch, an authority on ceramics and crystallography, will hold the chair for five years; its creation celebrates TDK's 50th anniversary.

Professor **Walter S. Owen,** who came to M.I.T. in 1973 to head what was then called the Department of Metallurgy and Materials Science, has retired from full-time teaching and research effective last June 30. Professor Owen was educated in England and taught at his alma mater, the University of Liverpool, before coming to the U.S. in 1966 to join the Cornell faculty. He was dean and vice-president at Northwestern University when called to M.I.T. His teaching and research have been in physical metallurgy—the mechanical behavior and brittle fracture of metals.

Stanley M. Wolf, Sc.D.'72, reports that he has joined the National Materials Advisory Board (NMAB) as a senior staff officer. The NMAB is a unit within the National Research Council.

Two deaths have been reported to the Alumni Association, with no further details available: **Myron P. Lepie,** S.M.'58, of Chestnut Hill, Mass., on May 9, 1985; and **Choji Nozaki,** S.M.'55, of Nagoya, Japan, on April 16, 1985.

IV ARCHITECTURE

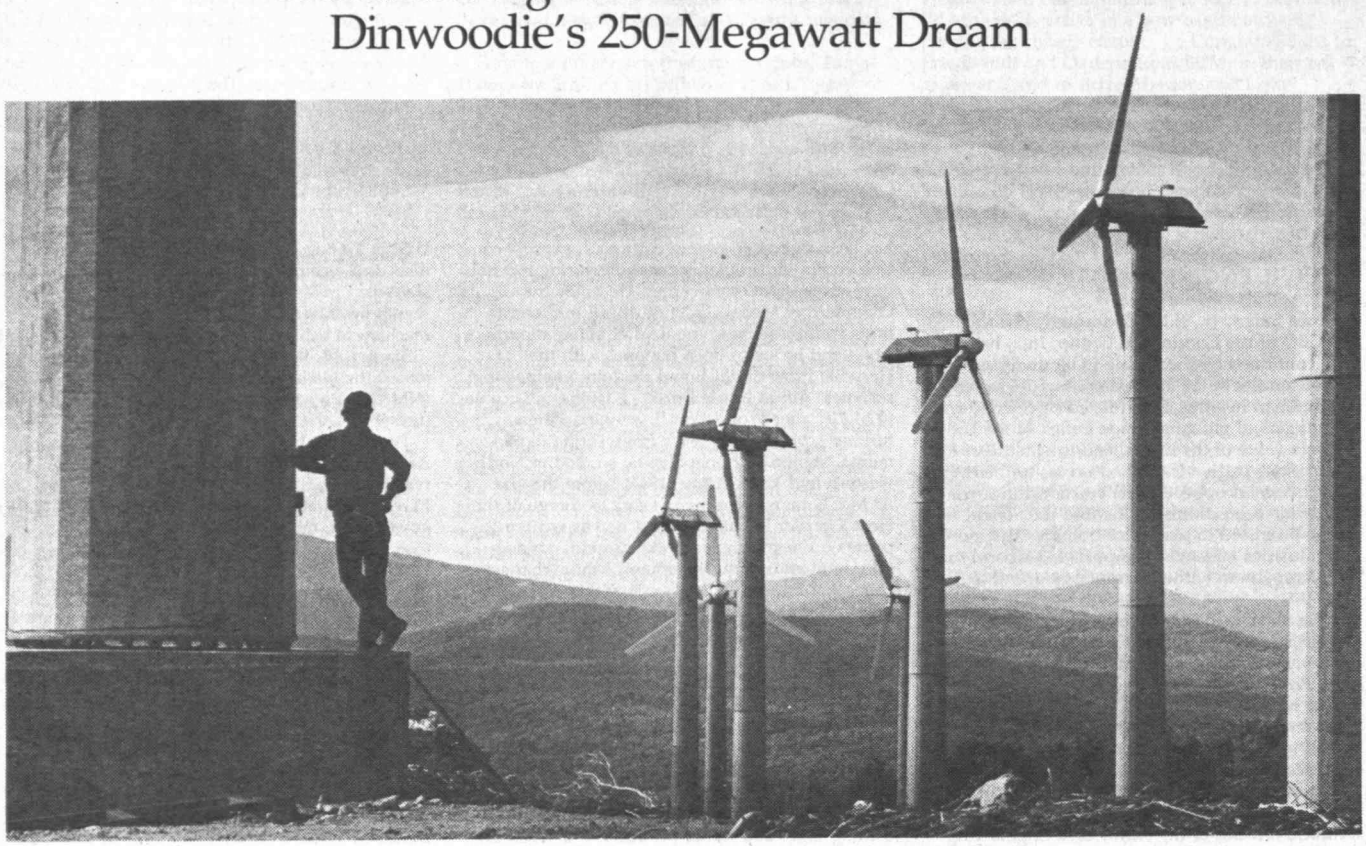
Teaching and research in lighting at M.I.T. has received a boost from the GTE Foundation—a $100,000 five-year grant made in behalf of GTE Lighting Products, Danvers, Mass. The funds will be used in the Laboratory of Architecture and Planning for facility development.

Professor **Robert O. Preusser,** a member of the architecture faculty at M.I.T. since 1957, has retired from full-time teaching effective last June 30. Educated at the Institute of Design, Chicago; Tulane; and the Art Center School, Los Angeles, Preusser began full-time teaching at the University of Houston and Houston Museum School in the 1950s. He came to M.I.T. in 1954 as a visiting lecturer while teaching part-time in the Harvard Graduate School of Design, and as a member of the M.I.T. faculty he's been teaching visual presentation, advanced visual design, painting, and environmental light and color.

Paul Sun, M.Arch.'66, a principal at Shepley

S. Bruce Smart, S.M.'47, accompanied by Mrs. Smart, is sworn in as undersecretary of commerce for the International Trade Administration by commerce secretary Malcolm Baldridge (left) last August.

Research Engineer Turned Windfarmer: Dinwoodie's 250-Megawatt Dream



Thomas L. Dinwoodie, S.M.'80, leans against one of the towers of a Micon 60/13 wind turbine located at TDEnergy's pioneering facility in Canaan, N.H. A second windfarm is due for completion next year on a mountainside in Florida, Mass.

Since 1981 Thomas L. Dinwoodie, S.M.'80, has been in pursuit of wind energy to lessen New England's dependence on fossil-fueled electricity. To date, his TDEnergy, Inc., has completed one windfarm—its pilot project—in Canaan, N.H., and has sites for two more in the Berkshire towns of Florida and Windsor, Mass.

Dinwoodie received his bachelor's degree from Cornell in environmental engineering in 1979 and came to M.I.T. to do his master's degree in mechanical engineering on transition energy technologies. Following graduation, he decided to remain at the Institute, continuing his research into energy-related topics (focusing on solar and wind systems.)

This work led him to Egypt, where he explored a project that proposed to combine of photovoltaics, wind, and diesel to power desalination—the process of preparing sea water for irrigation and human consumption. Involved in a project for the U.S. Agency for International Development, Dinwoodie then took his skills to Kuwait and the Philippines, proposing photovoltaic power to supply remote villages with drinking water.

But Dinwoodie, a man of action, presently found himself "frustrated writing papers as a research engineer, wanting to leave policy and get my hands dirty," he says. So he formed the Boston-based firm of TDEnergy, Inc., and since 1983 "has been committed to producing energy locally through sources of windpower."

TDEnergy's Canaan project has been in operation since last August. As of this writing, the site is equipped with ten Micon turbines, each capable of producing 65 kilowatts at peak rating.

Construction is expected to begin on the Florida facility—"Windstation Flora"—by early 1986, and be operational by the summer of 1986. The site will be comprised of approximately 115 wind turbine generators, and the power, sufficient for some 7,500 homes, will be sold to the Boston Edison Co. (with which TDEnergy has signed a 30-year agreement). Flora will become the largest wind-electric generation facility east of California, and its 10 megawatts will "represent the first significant contribution of the wind resource to the energy mix of the region," Dinwoodie says. The construction of the Windsor site is next on the agenda and future projects are slated for Vermont, New Hampshire, and New York State. In all, Dinwoodie's TDEnergy has "close to 250 megawatts of wind-electric capacity slated for development throughout the Northeast within five years."

But Dinwoodie's promising path to energy has not been so readily accepted. "I discovered that windmills are not all mom's apple pie," he says. Local opposition was met in Windsor and Florida, where people insisted that the windfarms would be unsightly, a source of noise pollution, hazardous to the environment, and create television inteference. But Dinwoodie's optimism is undimmed. "Once the projects are running, people will see the only real issue is aesthetics. Many will then think the projects look lovely."—*Valerie Kiviat*

PHOTO: TIMOTHY SAVARD/PHOTOWORKS

Bulfinch Richardson and Abbott, Boston, has been elected to the American Institute of Architects College of Fellows. Sun has gained worldwide recognition for his design, service and research, as well as teaching and lectures. His basic philosophy: "architecture should orient itself to the environment and surrounding physical conditions." . . . **Navroz N. Dabu,** S.M.'83, has joined the firm of Seppala & Aho Construction Co., Peterborough, N.H., as a draftsman. Before coming to the U.S., Dabu worked for the Indian government in interior and graphic design projects.

V CHEMISTRY

Professor **John M. Deutch,** '61, provost of M.I.T., heads a nine-member review panel studying the Midgetman nuclear missile program for the Department of Defense. The study was requested by Congress when its General Accounting Office said the Midgetman might be too small to strike U.S.S.R. targets and that there were other technical problems; the Deutch panel's report is due next January.

Schrade F. Radtke, Ph.D.'49, is the co-author of *Cooperative Research and Development*, a management briefing published for its members by the American Management Associations—a primer on the forms and management of cooperative organizations. Radtke knows whereof he writes: he retired last year as president and chief executive officer after a 25-year career with the International Lead Zinc Research Organization, Inc. Radtke is now president of his own consulting firm, Cosmos Engineering, Inc., in New Canaan, Conn.

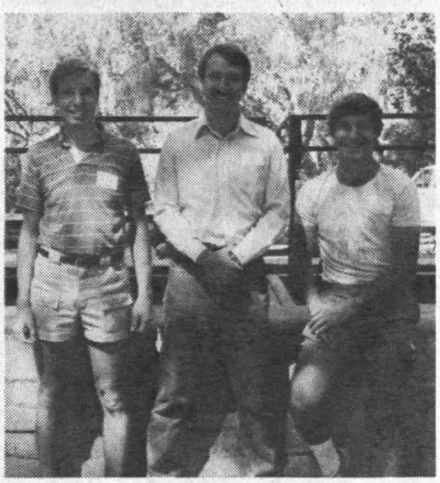
Stephen J. Lippard, Ph.D.'65, professor in the department at M.I.T., has been awarded the 1985 Henry J. Albert Award for Excellence by the Engelhard Corp. and the International Precious Metals Institute. Lippard was honored for his "achievements in the medical application of precious metal chemistry, particulary for his work on metal-nucleic-acid interactions." . . . **Robert E. Miller,** Ph.D.'49, has been named senior vice-president of Grain Processing Corp., Muscatine, Iowa, a supplier of grain neutral spirits for beverage and industrial use. . . . **David P. Toorchen,** Ph.D.'81, employed at Burroughs Wellcome Co., Research Triangle Park, N.C., writes, "I am working to develop nucleoside drugs effective against parasitic infection and malignancy."

Vincent R. Landi, Ph.D.'65, manager of the Engineering Plastics Group at Rogers' Lurie Research and Development Center, Rogers Corp., Conn., has been named chairman-elect of the Thermoset Division of the Society of Plastics Engineers. . . . **Edwin P. Przybylowicz,** Ph.D.'65, director of research at Eastman Kodak Co., Rochester, N.Y., has been elected a senior vice-president.

Ronald Francis, Ph.D.'64, professor of photographic arts and sciences at Rochester Institute of Technology, Rochester N.Y., has received the institution's Eisenhart Award for Outstanding Teaching. Among Francis' accomplishments: he worked on the Kennedy assassination case and is presently head of photographic research on General Electric's Shroud of Turin investigation. . . . **Frank Vellaccio,** Ph.D.'74, associate professor of chemistry who has been on the Holy Cross College (Worcester, Mass.), faculty since 1974, became acting dean effective June 1, 1985.

VI ELECTRICAL ENGINEERING AND COMPUTER SCIENCE

W. Daniel Hillis, S.M.'81, is one of "five geniuses who made a difference," selected for a recent issue of *U.S. News and World Report*. His achievement: design of a small supercomputer with 64,000 microprocessors that will operate in a "parallel processing" mode. Hillis is employed by Thinking Machines, Inc., Cambridge, and is continuing work on an M.I.T. doctoral thesis.



Above: Some 30 alumni and 20 students attended the 7th Annual West Coast VI-A picnic held last August 18 hosted for the first time jointly with the M.I.T. Club of Northern California. Left: Picnic coordinators, left to right—J. W. Jarve, Jr., '78; John D. Chisholm, '75; and Michael R. Crystal, '86. Photo: John A. Tucker

After a 25-year career in dielectric materials as president of Furane Plastics, Inc., **John Delmonte,** S.M.'34, has retired to be chairman of Deisen Testing Laboratories, Glendale, Calif., and to write a book: *Origins of Materials and Processes* (Lancaster, Pa.: Technomic Publishing Co., 1985). It's described as "an encylopedic presentation of the sources of materials and technology."

Professors **Joseph C.R. Licklider** and **John M. Wozencraft,** Sc.D.'57, have retired from full-time research and teaching in the department at M.I.T.; both are continuing part-time activities in Cambridge. . . . Licklider was trained in psychology at Washington University, St. Louis, and the University of Rochester (Ph.D. 1941), and he taught in that field at Swarthmore, Harvard, and M.I.T. before joining Bolt, Beranek and Newman, Inc., in 1957. There he became intrigued with the problems of man-computer interaction that have since been the focus of his professional work. Licklider returned to M.I.T. as professor of electrical engineering in 1967. . . . Wozencraft's interests are in the field of communications, information theory, and computer languages. He first served in the Signal Corps following graduaton from West Point, came to M.I.T. for graduate work in 1950, and joined the faculty upon completing his Sc.D. in 1957.

Robert R. Everett, S.M.'43, president and chief executive officer of the Mitre Corp., received an honorary doctor of engineering degree from Northeastern University, Boston, last June 16. The citation honored Everett as a "brilliant scientist, entrepreneur, and businessman." . . . Two alumni have been elected to the National Academy of Engineering: **Willis H. Ware,** S.M.'42, a corporate research staff member at the Rand Corp., Santa Monica, Calif., cited for his "pioneering contributions to computer technology"; and **Robert Price,** chief scientist at M/A-Com Linkabit, Inc., Lexington, Mass., for "pioneering achievements in applying statistical communication theory to radio communication, radar astronomy, and magnetic recording."

Raymond A. Bruce, S.M.'61, director of AT&T's Digital Terminal Laboratory, Holmdel, N.J., passed away on April 13, 1985 of a sudden heart attack; no further details are available.

VI-A Internship Program

The 7th annual West Coast VI-A picnic was held Sunday, August 18, at Stevens Creek Park in the hills just west of San Jose, Calif. An innovation this year, which we hope will continue, was the co-sponsorship of the event by the M.I.T. Club of Northern California. Some 30 VI-A alumni/ae and about 20 students came to this very successful affair. The two alumni coordinators for the picnic were **John D. Chisholm,** '75, and **John W. Jarve, Jr.,** '78. The student on the coordinating committee was **Michael J. Crystal,** '86, currently on VI-A assignment at Schlumberger Palo Alto Research Center. All three worked enthusiastically and assiduously to produce one of the best gatherings we've had.

The oldest attendee was **Richard T. Perry,** '25, who was accompanied by his wife, Peg. A not-so-oldtimer also attending was **Russell C. Coile,** '38, who drove up from Monterey and brought with him some old copies of *Sparks*, a one-time VI-A yearbook. These brought the comment from current students: "Why don't *we* have something like this?"

From the reservation list, and other names I jotted down, I have put together a probably-not-quite-complete list of attendees (please inform me of errors or omissions): **Thomas L. Bentley,** '73 (H-P Labs.); **Richard A. Blandchard,** '68; **Paul E. Braisted,** '79 (with Trimble Navigation, Mountain View); **Thomas M. Chen,** '83 (graduate student, Berkeley); **John D. Chisolm,** '75 (alumni coordina-

tor; consultant, Menlo Park,); **Russell E. Coile,** '38 (Pacific Grove); **Robert M. Colopy,** '74 (consultant; Los Altos); **John F. Cooper,** '74 (Dolby Labs., San Francisco); **John A. Edighoffer,** '73 (TRW, Redondo Beach); **J. Payne Freret, Jr.,** '68; **Steven T. Kirsch,** '78 (Mouse Systems Corp., Sunnyvale); **Abraham Lederman,** '80 (Convergent Technologies, San Jose); **Carl W. Linde,** '85 (Industrial Networking, Inc.); **Jack S.H. Liu,** '70 (ESL, TRW subsidiary, Sunnyvale); **Alan M. Marcum,** '78 (H-P Labs., Palo Alto); **Richard T. Perry,** '25 (retired); **Lynn M. Roylance,** '72 (H-P Labs.); **Paul E. Stoft,** '49 (H-P Co.; VI-A Coordinator); **Peter A. Stoll,** '71; **David F. Tuttle, Jr.,** '37 (professor, Stanford); **Kenneth A. Van Bree,** '71 (VI-A coordinator at H-P Labs.); and **John A. Tucker.**

Another pleasant experience came the day before the picnic when I attended a post-wedding luncheon at the home of **John F. Cooper,** '74, and his wife in El Granada—inasmuch as I was unable to attend their August 3, 1985, wedding. It was a delicious meal prepared by his wife, Melissa. John is with Dolby Laboratories, Inc., San Francisco.

Continuing on to Dallas, I attended this year's TI VI-A luncheon which was held at the Petroleum Club on Thursday, August 22. This 13th in the annual series, originally conceived and initiated by **Cecil H. Green,** '23, was unfortunately held without its founder for the first time. Mr. Green was unable to attend due to his wife's recuperation from a recent operation. In his stead was TI's vice-president of corporate services, **Joseph D. Zimmerman,** '59, as master of ceremonies, who began the after-dinner speeches by reading a letter from Cecil Green for the occasion. "Joe Z" then reminisced about his own days in VI-A, working at General Radio Co. (now GenRad). He noted that his son, **Dale,** '81 (who was present), also graduated from VI-A and was to be married the following Saturday. Incidentally, **Jon P. Wade,** '82, who was to be in Dale's wedding party, came to the luncheon.

Other VI-A alum's from TI included: **Jeffrey D. Beck,** '70; **Dean R. Collins,** '58; and **Christopher Slawinski,** '83.

Mr. Zimmerman then introduced Director **John A. Tucker,** who spoke about the program and its future and closed by acknowledging the contribution which TI managers made to the educational experience of VI-A and thanked them on behalf of the M.I.T. faculty. After Cecil Green's tradition of having each of the VI-A students speak about his work, Mr. Zimmerman called on Dolan McDaniel, president of Geophysical Service, Inc. (GSI) and a TI vice-president. Dolan told about Cecil's getting GSI involved in the VI-A Program, the company's excellent experience these past two years, and the exceptional educational opportunity VI-A students have.

During the San Francisco/Dallas trip, I visited our VI-A students at Fairchild/Schlumberger, Hewlett-Packard, IBM Corp., ROLM Corp., Texas Instruments, and Xerox PARC. I am happy to report assignments at all these companies were challenging and well coordinated.

I sadly report the death of **Donald B. Sinclair,** '31, an illustrious VI-A alumnus who rose to be chief executive officer and chairman of the Board of the General Radio Co. He served as president of the Institute of Radio Engineers which later merged with the AIEE to become today's Institute of Electrical and Electronics Engineers, of which he was a fellow. He was 75 at the time of his death.

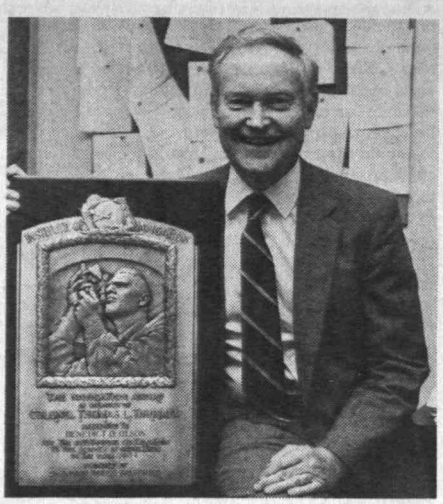
Since our last writing the VI-A Office had a visit from **Arthur C. Chen,** '61, who is manager, Information Systems Lab., Corporate Research and Development, G.E. Co., Schenectady, N.Y.—John A. Tucker, Director, VI-A Internship Program, M.I.T., Room 38-473, Cambridge, MA

VII BIOLOGY

The Department of Biology at M.I.T. has new leadership: Professor **Maurice S. Fox** is head, and Professor **Richard O. Hynes,** Ph.D.'61, is associate head. Professor **Gene M. Brown,** the former head, has gone on to become dean of science. Fox, the Lester Wolfe Professor of Molecular Biology, is a specialist in the molecular mechanisms of genetic recombination, one of the first scientists to realize the advantages of simultaneously marking DNA both physically and genetically to facilitate studies of both structure and function. Hynes, whose first faculty appointment was in 1975, is a specialist in fibronectins—proteins involved in cell adhesion and migration.

Everything is in place "for a successful targeted economic development effort in the medical products/health serivces industry in Minnesota," says **Marilyn L. Bach,** '60, of the Minnesota Department of Economic Development. Indeed, it's her job to implement the recommendations of a Task Force on Biotechnology, coordinating national and international marketing of the state's health care resources. Minnesota's is "the best medical climate in the world," says Bach.

John M. Burke, Ph.D.'83, assistant professor of chemistry at Williams College, Williamstown, Mass., has been awarded a $90,000 grant by the National Science Foundation, for research utilizing genetic engineering technology. Burke will make specific changes in the structure of RNA molecules and then study the reactions carried out by the altered molecules. . . . **O. Robert Mitchell,** Ph.D.'72, professor of engineering at Purdue University, West Lafayette, Ind., has been named assistant dean for industrial relations and industrial research. . . . **Roland F. Beers, Jr.,** Ph.D.'51, of Dorset, Vt., who was a member of the M.I.T. staff for 5 years after completing his doctorate, passed away on March 20, 1985.



Benedict Olson, S.M.'52, poses with his Thurlow Award for oustanding contributions to the field of navigation. (Photo: Draper Laboratory)

VIII PHYSICS

Professor **Anthony P. French** of M.I.T. is co-editor with P. J. Kennedy of the University of Edinburgh of *Niels Bohr: A Centenary Volume* (Harvard University Press, 1985). It's described as "a multidimensional view of this complex man, combining penetrating assessments with Bohr's own insightful writings." . . . Returning to the department after five years as provost of M.I.T., **Francis E. Low** has been named Institute Professor. The title is an honor initiated by faculty colleagues; in Low's case it recognizes "singular accomplishments as a physicist and as a leader at M.I.T.," says Professor Arthur C. Smith, former chairman of the faculty.

Herbert S. Bridge, Ph.D.'50, retired from full-time teaching, research, and administrative work at M.I.T. last June 30 after achieving an international reputation in cosmic ray and space physics. Dr. Bridge has been at M.I.T. ever since he came to be a graduate student in 1946. He joined the faculty in 1966, a year after he became associate director of the Center for Space Research at the time of its inception; he became its director in 1978. After early work on cosmic rays, Bridge turned to the field of space physics in 1958, developing experiments that brought M.I.T. a leading position in the field of plasma measurements in outer space and in the solar system.

Major **John C. Szczepanski,** S.M.'80, has recently completed the U.S. Army Command and General Staff College regular course at Fort Leavenworth, Kan. The ten-month course prepares officers as military problem solvers with emphasis on career development. Szczepanski continues to serve as Fort Leavenworth with the student attachment. . . . **John W. McWane,** Ph.D.'70, employed by Hewlett-Packard, Waltham, Mass., was a successful candidate for a second three-year term on the Hamilton/Wenham (Mass.) School Committee.

Benedict Olson, S.M.'52, chief engineer of the Navy Department at the Charles Stark Draper Laboratory, Cambridge, was awarded the 1985 Institute of Navigation's top honor—the Thurlow Award. . . . **David W. Oliver,** Ph.D.'61, a physicist at the General Electric Research and Development Center, Schenectady, N.Y., holds one of the Center's silver patent medallions for filing his

tenth patent application. . . . **Jerome Apt III,** Ph.D.'76, an engineer at the Johnson Space Center, was recently selected to the astronaut corps by the National Aeronautics and Space Administration.

X CHEMICAL ENGINEERING

Professor **Daniel I. C. Wang,** '59, director of the Biotechnology Process Engineering Center at M.I.T., now holds the Chevron Professorship in the department. Wang's thesis adviser as an undergraduate was the first Chevron Professor (*see below*)

Two long-time and distinguished members of the department's faculty have retired from full-time teaching and research; Professors **Robert C. Reid,** Sc.D.'54, and **Glenn C. Williams,** Sc.D.'42. . . . Reid, who has held the Chevron Professorship at M.I.T., is a specialist in phase transitions in superheated liquids—an interest that led him to important research in the handling, transportation, and the storage of liquefied natural gas (LNG); he's also made contributions in supercritical extraction processes. Reid holds the Warren K. Lewis Award (1976) of AIChE with a citation for "extraordinary classroom teaching," and he has been in demand as a lecturer and visiting professor. . . . Williams has been a member of the faculty since 1942, and he started teaching two years earlier while completing his Sc.D.—a career of nearly 45 years. He is widely recognized for research and teaching in the fields of combustion and chemical thermodynamics, and he was involved in management and research of the Fuels Research Laboratory for most of his faculty years. Williams has been director, secretary, vice-president, and president of the Combustion Institute and has had editorial responsibilities for *Fuel* magazine.

Captain **William A. Sweet,** S.M.'77, has completed the nine-week course at the Army's Combined Arms and Services Staff School, Fort Leavenworth, Kan., and is now assigned to the U.S. Military Academy, West Point, N.Y. . . . **Robert L. Slifer,** S.M.'50, has been named president of Montelle Vineyards, Augusta, Mo., a small innovative winery in the first American viticultural area. Slifer joined the firm in 1980 after taking early retirement from Monsanto. His newest project is a unit to plant and care for new vineyards. . . . **Ronald E. Rosensweig,** senior research associate in the Corporate Research Science Laboratories of Exxon Research and Engineering Co., Annandale, N.J., has been elected to membership in the National Academy of Engineering. Rosensweig was cited for "discoveries and endeavors spawning new technology applications of magnetic fluids and ferrohydrodynamics."

The Melchett Medal of England's Institute of Energy has come to **Janos M. Beer,** professor of chemical and fuel engineering at M.I.T. Beer is scientific director of the M.I.T. Combustion Research Facility; his new prize recognizes "outstanding contributions in energy research and technology."

Bernard Chertow, Sc.D.'48, has been elected president of Galson Research Corp., E. Syracuse, N.Y., a research firm designed to exploit new technology for destroying highly toxic materials such as PCBs and dioxin. . . . **Edward Rolfe,** S.M.'51, writes, "Currently president of American Research and Engineering, Lincoln, Mass. Active for many years in design, analysis, and licensing of nuclear power plants, our computer group has now expanded into the fields of manufacturing, resource planning, MIS, factory automation, and robotics." . . . **Charles K. Walker,** S.M.40, of Mission Viejo, Calif., reports that he retired three and one half years ago from Fluor Corp., after almost 35 years of service. . . . **Ernest O. Ohsol,** Sc.D.'39, reports that he is "working as a consultant and has developed training programs for petroleum companies in Nigeria and Saudi Arabia."

XII EARTH, ATMOSPHERIC AND PLANETARY SCIENCES

A four-year $800,000 research fund in the form of a Secretary of the Navy Research Chair in Oceanography came to **Carl I. Wunsch,** '62, Cecil and Ida Green Professor of Physical Oceanography at M.I.T., last summer. The idea is to call attention to "the renewed focus within the Navy on basic oceanographic research" by recognizing distinguished scientists in marine fields.

Two alumni have made news at Northern Illinois University, DeKalb: **Eugene C. Perry,** Ph.D.'63, a geology professor, has been awarded a Fulbright grant to conduct research on the interaction of fresh groundwater, seawater, and carbonate rocks that takes place in Mexico's Yucatan Peninsula; and **Carla Westlund Montgomery,** Ph.D.'77, has been named associate dean of the Graduate School, effective July 1, 1985. Prior to this appointment she served as associate professor and assistant chairman of the Geology Department and is presently completing a freshman-level textbook in environmental geology to be published in 1986 (William C. Brown Co.)

Institute Professor Emeritus **Martin J. Buerger,** '25, personally handed the first Buerger Award in X-Ray Crystallography to William R. Buy on August 19, 1985, at a meeting of the American Crystallographic Association, in Palo Alto, Calif. The award was made possible by an endowment raised by friends, colleagues, and students to honor Professor Buerger for "his major contributions to many areas of crystallography, including crystal growth, morphology, structure analysis, phase transformation, and instrumentation." . . . **Clifford Frondel,** Ph.D.'39, one of Buerger's early students who is now professor emeritus at Harvard, was recently elected an honorary member of the All-Soviet Mineralogical Society, in recognition of his many important contributions to the science of minerals, including authorship of the 7th edition of the classic Dana *System of Mineralogy*, which has been translated into Russian and Chinese.

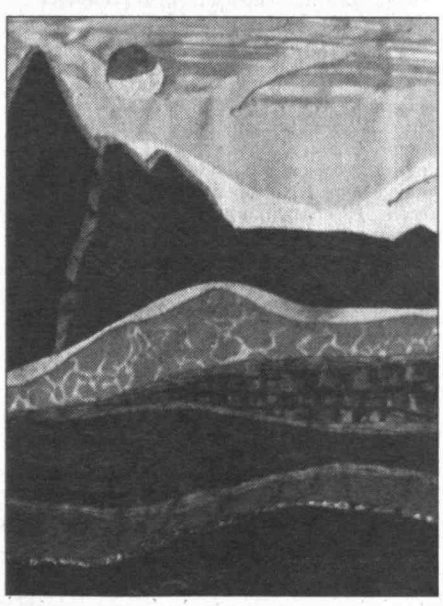
Gabrielle Donnay, Ph.D.'48, another of Professor Buerger's students, received the 1983 Past-Presidents' Gold Medal from the Mineralogical Association of Canada. She was the first woman, and the second individual, to receive the award, and was the first woman ever to receive a gold medal from the association. . . . Professor **Roger B. Burns** in the department at M.I.T. recently received an Sc.D. degree from Oxford University, England, in recognition of his contributions to the field of transition metal geochemistry and mineral spectroscopy during the past 15 years. Professor Burns was a faculty member of Oxford's Department of Geology and Mineralogy before coming to M.I.T. in 1970.

Charles C. Counselman III, 64, professor of planetary sciences, in 1983 became the first American to receive the Carl Pulfrich Prize, founded by Carl Zeiss, Inc., West Germany, which recognizes "pioneering theoretical and practical work in the field of surveying and geodesy." Professor Counselman was cited for his work on short-baseline interferometry. . . . **Thomas J. Ahrens,** '57, and two co-authors received the AAAS-Newcomb Cleveland Prize for their report, "Densities of Liquid Silicates at High Pressures," published in *Science* (November 30, 1984, pp. 1071-74). The prize is "awarded annually to the author(s) of a paper published in *Science* that is considered to be an outstanding contribution to science." . . . **Daniel G. Kelley,** Ph.D.'59, director of the External Strategies Branch of Environment—Canada's environmental service—is the first Canadian ever to receive the prestigious S. Griswold Award for outstanding work in the field of air pollution.

Patrick M. Hurley, Ph.D.'40, now professor emeritus, was recently elected an honorary member of the Geological Society of London in recognition of his age-determination of many rocks around the world and use of that information in support of the concept of plate tectonics. Recently elected to the National Academy of Sciences are **Stanley R. Hart,** '56, and **B. Clark Burchfiel,** both professors of geology at M.I.T.

The William Otis Crosby Lecturer for 1986 will be Wayne A. Pryor, professor of geology at the University of Cincinnati. He will deliver a series on "Principles of Petroleum Geology," a field in which he has worked closely with industry, serving as a consultant for many oil companies. The endowed lectureship was established by **Irving B. Crosby,** '17, to honor his father, **William Otis Crosby,** VII, 1886, who was the fifth M.I.T. professor of geology (1880-1907) and one of America's earliest engineering geologists. . . . Professor Emeritus **William H. Pinson,** Ph.D.'52, now residing at 94 Glendale, Quincy, Mass., will be teaching astronomy and the earth sciences at three neighboring schools during the current school year: Tufts, Bridgewater College, and Bentley College. He is still making long canoe trips into the Canadian North with his son Harlow.

Geophysicist **Anthony ("Tony") England,** '64, was one of the scientist astronauts on the space shuttle *Challenger* flight in late July. He has reported that he carried a specially prepared M.I.T. flag with him on the flight. . . . **Paul T. Walton,**



M.I.T. had two respresentatives aboard the 19th manned mission of the Space Shuttle Challenger last July 29—geophysicist Anthony ("Tony") England, '64, and this flag that England carried into space and back again. The flag representative of M.I.T.'s Department of Earth, Atmospheric and Planetary Sciences and Earth Resources Laboratory was the product of fabric designer Susan K. Turbak, office assistant in the department.

The flag, 13 1/2" by 16 1/2", consists of silk remnants, the least flammable of fibers, and took 18 hours to piece together. It presently is the the possession of Astronaut England, with its future residence yet undetermined.

Ph.D.'42, is an independent geologist, founder of Walton and Associates, Salt Lake City, and owner of the 632-acre Walton Ranch near Jackson, Wyo. On December 14, 1983, the *Jackson Hole News* announced that the Walton family had donated a conservation easement on the Walton Ranch, between Jackson and Wilson, to the Jackson Hole Land Trust. The donation, valued in the millions of dollars, assures that the Walton Ranch can never be developed—hence, must forever remain in an open state for the enjoyment of future generations.

Robert ("Bob") Bowman, Ph.D.'55, passed away on August 9, 1983, during open-heart surgery. He was software deployment and documentation manager with Texas Instruments, Inc., Dallas. . . . **Orville Frank Tuttle,** Ph.D.'48, of Tucson, Ariz., passed away on December 13, 1983, after a long illness with Parkinson's disease. He was a member of the National Academy of Sciences and before retirement had performed distinguished experimental work on igneous rocks at the Geophysical Laboratory, Washington, D.C. . . . **David R. Wones,** '54, professor of geology at Virginia Polytechnic Institute and State University, was killed in an auto accident late in 1984; no further details are available. . . . **Roland F. Beers,** Ph.D.'42, a geophysicist, passed away in Manchester, Vt., on July 9, 1985, after a long illness.—Robert Shrock, Professor Emeritus, M.I.T. Room 24-404, Cambridge, MA 02139

XIV ECONOMICS

After interviews with 90 top leaders—executives, political figures, coaches, symphony and film directors—**Warren G. Bennis,** Ph.D.'55, concludes that leadership requires four areas of competency: "attention through vision, the means to communicate vision, positive self-regard, and building trust with associates." Bennis is professor of management at the University of Southern California, and a full report of his project is the subject of his book, *Leaders* (Harper and Row, 1985).

Another author among the department's alumni: **Clark C. Abt,** Ph.D.'65, founder and president of Abt Associates, Inc., Cambridge. His book is *A Strategy for Terminating a Nuclear War* (Westview Press, 1985), and he proposes that "a strategy of termination is also an effective form of prevention." And that, he writes, "is what this book is about."

Professor **Franklin M. Fisher** of M.I.T. is the editor and principal author of *Antitrust and Regulation* (M.I.T. Press, 1985), a collection of essays in honor of the late John J. McGowen, formerly vice-president of Charles River Associates, Boston. Among the contributors are M.I.T. professors **Morris A. Adelman** and **Paul L. Joskow**.

A $250,000 gift from **John K. Castle,** '63, president and chief executive officer of Donaldson, Lufkin and Jenrette, is funding a graduate fellowship in the department at M.I.T. Castle made his gift in honor of his grandfathers, Elra Castle and Joseph Krob, for "entrepreneurial skills, pioneering spirit, compassion, and good citizenship" that provide a model for himself and others who are leading American industry. The occasion for the announcement was a reception for the New York financial community hosted by Castle to honor distinguished members of the M.I.T. economics faculty late last spring.

XV MANAGEMENT

Dean **Abraham J. Siegel** chose a news conference in New York last September to announce major funding for the Sloan School's "Management in the 1990s" program (*see February/March, p. 79*) by 10 sponsors: American Express, Arthur Young and Co., BellSouth, British Petroleum, Digital Equipment Corp., General Motors, International Computers Ltd., the Internal Revenue Service, Eastman Kodak, and MCI Communications Corp. In addition to funding, the sponsors will provide data and research sites for the five-year $5 million study of the impact of information technology on organizations and their management practices. Professor **Michael S. Scott Morton** is director.

Professor **Denis F. Simon,** the Sloan School's chief "China-watcher," has a new assignment: a research grant from the Committee on Scholarly Communications with the PRC to study the technological choices made by Chinese enterprises and the role of foreign technology in Chinese industrial development. Simon was a principal participant in a seminar on technology transfer to China last month under sponsorship of the U.S. National Academies of Science and Engineering and China's State Science and Technology Commission.

Rockwell Hereford, '24, is the author of *A Whole Man and a Half Century* (Boxwood Press, Pacific Grove, Calif., 1985, $19.50), a biography of Henry Mauris Robinson, an influential California businessman/philanthropist between 1890 and 1940. Robinson was a key—but typically behind-the-scenes—figure in creating Caltech and the Huntington Library and a major factor in the organization of many important industries in Southern California. Hereford's biography provides "new material on California history, a fresh perspective on free enterprise, and a revealing look at the politics of the Great Depression, writes his publisher.

Wilbur G. Lewellen, S.M.'61, Loeb Professor of Management at Purdue University's Krannert School of Management, West Lafayette, Ind., has been named director of the school's executive programs. . . . **Bertram C. Shlensky,** Ph.D.'70, has joined WestPoint Pepperell as president of the Apparel Fabrics Division, New York City. Prior to this appointment he was president of Talbott Knitting Mills (since 1981). . . . **Ronald C. Buehner,** S.M.'62, has been promoted to corporate vice-president of Lear Siegler, Inc., Santa Monica, Calif., while retaining his former responsibilities as vice-president, management services.

Steven Russell Kanner, S.M.'74, writes, "After several years of management consulting and public sector health management, I am now happily practicing medicine in Weston and Wayland, Mass." . . . **Winford G. Ellis,** S.M.'74, reports that since May 20, 1985, he has been deputy senior member at the Nuclear Propulsion Examining Board, staff, commander in chief, U.S. Atlantic Fleet, Norfolk, Va. . . . **John A. Fanning,** S.M.'65, has resigned as president and chief executive officer of Western Co. of North America, Fort Worth, Tex. . . . **David Wayne Talafuse,** S.M.'76, earned his M.D. last May from the University of Texas Health Science Center at San Antonio and is now undertaking a family practice residency at the same institution. . . . **John B. Lamb,** S.M.'77, of Wellesley, Mass., passed away on May 31, 1985; no details are available.

Sloan Fellows

Stanley J. McLaughlin, S.M.'83, has been appointed chief engineer for the Union Pacific Railroad portion of Union Pacific System, Omaha, Neb. Since 1983, McLaughlin has been assistant chief engineer-track for the System's Missouri Pacific Railroad. . . . Two alumni have been elected to membership in the National Academy of Engineering: **Howard H. Kehrl,** vice-chairman of the board at General Motors Corp., Detroit, Mich., in recognition of "his outstanding contributions to the advancement of automotive science and engineering"; and **Philip M. Condit,** vice-president of marketing and sales for Boeing Commercial Airplane Co., Seattle, Wash., for "exceptional technical leadership in design and advancement of commercial jet transport aircraft."

Frank J. Bellafato, S.M.'75, has been named manager of the Chevrolet-Pontiac-Canada Group Framingham (Mass.) Assembly Plant. Since 1981 Bellafato had served as production manager of the Doraville Assembly Plant in Georgia. . . . **Guy W. Nichols, Jr.,** S.M.'61, retired chairman, presi-

dent and chief executive officer of New England Electric System, has become a director of Hanover Insurance Co., Worcester, Mass. . . . **Albert L. Baker, Jr.,** S.M.'65, passed away in March 1985; no further details are available.

Senior Executives

Salvatore Macera, '68, chairman of Bristol Medical Electronics Corp., has been elected a director of the International Insurance Group, Ltd., Boston. . . . **Andre Gillet,** '68, has become chairman instead of president but retains the title of chief executive officer at International Multifoods Corp., Minneapolis, Minn.

Management of Technology Program

Erik Chaum, S.M.'84, stopped by the office in July to report that he is continuing the process of raising funds for 10 Point Systems. There are six employees, three partners, plus three others. Meanwhile, they are expanding their business to include some software contracting work to "tide them over." . . . A friend of **A. Peter M. Drummond,** S.M.'85, reported that Peter was continuing to interview in Britain and the prospects look good. . . . **David C. Hite,** S.M.'84, telephoned in August to report a move and new company name. He is now president for Journeyman's Software, Inc., the company he started with his brother to provide software products for the construction industry. He commented that it was going very well. David moved to Arlington, Va., on August 1. "This is the first time in eight years I have all my belongings in one place," he said.

Eugene W. Huang, S.M.'85, is enjoying his new position with Booz, Allen and Hamilton as associate, after what he describes as "a bumpy start." . . . **John P. Kindinger,** S.M.'85, surprised us with a visit last July; it turns out his new job as senior consultant with Pickard, Lowe, and Garrick, Newport Beach, Calif., sent him right back to New England with a project in Manchester, N.H. His wife Cynthia will stay with her teaching job in Michigan until their house is sold.

Kenneth W. Miller, S.M.'82, was at M.I.T. last August 20 and had lunch with the current MOT students. He really loves his new position with AT&T Federal Systems and had a good discussion with the current students on his responsibilities as head of the Advanced Technology Business Development Department. . . . Jane Morse called **Henry M. Montrey,** S.M.'82, at the end of August to let him know she'd be in Seattle in September only to find out he'd be leaving Weyerhaeuser two days before she arrived. Hank will start in September with an exciting new position (that "fell in his lap") as deputy director for the U.S. Forest Products Laboratory, Madison, Wis. Lynn and the children will be staying in Tacoma until the house sells but hope to be able to join him soon. Hank planned to do a lot of traveling—to Washington, D.C. (and maybe up to Boston), then on to Geneva, Switzerland, toward the end of the month.—Jane Morse, Program Manager, M.I.T., Room E52-125, Cambridge, MA 02139

XVI AERONAUTICS AND ASTRONAUTICS

The department at M.I.T. has a new head—Professor **Eugene E. Covert,** Sc.D.'58, a specialist in high-lift and unsteady-state aerodynamics. He succeeds Professor **Jack L. Kerrebrock,** now associate dean of engineering. A native of South Dakota, Covert first studied aeronautics at the University of Minnesota; he came to M.I.T. in 1952 to work at the Naval Supersonic Laboratory, joining the faculty in 1963. Covert is known for development of the first magnetic wind tunnel suspension used in the U.S. and later for work with Professor **James W. Mar,** '41, to design the department's Unified Engineering sophomore subject.

Satya N. Atluri, Sc.D.'69, is now Regents' Professor of Mechanics and director of the Center for Advancement of Computational Mechanics at Georgia Tech, and he's also editor-in-chief of the *International Journal for Computational Mechanics.* "I strongly assert," he writes, "that computational mechanics is crucial for sustaining the leading role of the U.S. in aerospace, microelectronics, and supercomputers . . . (disciplines) poised to make revolutionary changes in the way engineering is practiced."

XVII POLITICAL SCIENCE

Walter Dean Burnham has succeeded the late Ithiel D. Pool as holder of the Ruth and Arthur Sloan Chair in the department at M.I.T. Professor Burnham, at M.I.T. since 1971, is considered a leading specialist in American politics, the author of a controversial theory on 30-year cycles for political realignments in the U.S.

XXI HUMANITIES

Professors **Leo Marx** and **Eugene B. Skolnikoff,** '49 (political science) of M.I.T. are among the editors of *Visions of Apocalypse: End or Rebirth?* (New York: Holmes and Meier, 1985), a collection of essays on the role of science and technology in apocalyptic visions. Among the authors: Professors **Harald A. T. Reiche, Robert Morison** (science and society), and **Philip Morrison** (physics).

Merritt Roe Smith, M.I.T. professor of the history of technology, is the editor of *Military Enterprise and Technological Change: Perspectives on the American Experience* (M.I.T. Press, 1985, $30). The thesis is that the armed forces' sponsorship of managerial as well as technological research has made them an integral, if reluctant and often overlooked, element in U.S. industrial power. Among the authors: **Peter Buck,** associate professor of the history of science at M.I.T., and **David F. Noble,** associate professor of history at Drexel who formerly taught at M.I.T.

XXII NUCLEAR ENGINEERING

Professor **David J. Rose,** Ph.D.'50, has retired from full-time teaching and research at M.I.T., effective last June 30. He is teaching part-time at the Institute this fall and will have a continuing affiliation with the East-West Center in Honolulu. After completing his doctorate at M.I.T., Rose went to Bell Labs in 1950; he returned in 1958 to join the faculty in the then-new Department of Nuclear Engineering, in charge of teaching in the field of controlled nuclear fusion. Since then, Rose's interests have turned to the interface of engineering and societal issues, and in the 1970s he offered the Institute's first academic subjects in energy policy and the environmental aspects of technical developments.

Leonard S. Cohen, S.M.'59, formerly executive vice-president of Scientific Leasing, Inc., Farmington, Conn., has recently became president of the firm. . . . **Robert H. Wilcox,** S.M.'58, was made public information chairman (1984-85) for the Northeastern Section of the American Nuclear Society. . . . **David B. Laning,** Sc.D.'83, writes, "I've been working on artificial intelligence and expert systems for use in project management and computer-aided engineering."

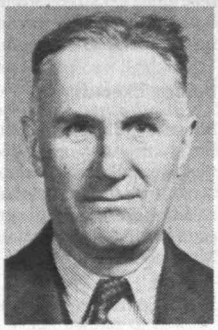
William T. McCormick, Jr., Ph.D.'69, president and chief operating officer of American Natural Resources Co., Detroit, Mich., has been chosen a director of NBD Bancorp, Inc. . . . **Richard R. Sonstelie,** S.M.'68, formerly vice-president of finance, has been elected executive vice-president at Puget Sound Power and Light Co., Bellevue, Wash. In his new role McCormick has responsibilities in the company's financial, budget, and customer service operations. . . . **John R. Wolberg,** Ph.D.'62, is professor of mechanical engineering at Technion and is the author of the recently-published *Conversion of Computer Software.*

TECHNOLOGY AND POLICY PROGRAM

Philippe Jolly, S.M.'85, will be working for DUMEZ, a civil engineering company in Saudi Arabia. . . . **Joseph Karam,** S.M.'85, is working in Washington, D.C., for ICF. . . . **Lissa Martinez,** S.M.'80, will be working in the office of the U.S. Coast Guard Commandant in Washington, D.C. Lissa served as chair of the committee on arrangements for the 1985 National Alumni Conference in Cambride in September. . . . **Jeremy Newberger,** S.M.'84, is now a project engineer for Energy Investment, a consulting firm in Boston.

A $34,500 grant to TPP will support new research by Professor **David H. Marks** and the undersigned on planning, pricing, and managing water supplies. It's a classic problem in management (mismanagement?) of technology, says Marks in a statement of appreciation to the sponsors, the Jessie Smith Noyes Foundation.—Richard de Neufville, Chairman, Technology and Policy Program, M.I.T., Room 1-138, Cambridge, MA 02139

P. M. Morse



S. Ober

Philip M. Morse, 1903-1985: Pioneer of Operations Research

Philip M. Morse, professor emeritus of physics who joined the M.I.T. faculty in 1931, died in Concord, Mass., on September 5. He was 82.

Professor Morse was a major figure in academic physics in the U.S. during the years following World War II. He received his doctorate in physics at Princeton in 1929 under then-Professor Karl T. Compton, and he came to M.I.T. in 1931 at Compton's invitation after the latter became president of the Institute. He rose to become full professor in 1938.

Morse was on leave from M.I.T. beginning in 1940 for nearly a decade to fulfill various government assignments. During the first years of World War II he directed research on sound control and underwater sound for the National Defense Research Council, earning the President's Medal of Merit for contributions to antisubmarine warfare. For six years beginning in 1942 he was director of the Navy's Operations Research Group, pioneering the applications of this new analytical method to weapons assessment and military strategy. This work led him in two directions: he organized a peacetime operations research team for the Joint Chiefs of Staff which evolved into the Weapons Systems Evaluation Group, later the Institute for Defense Analyses. And at about the same time Morse became the founding director of the Operations Research Society of America.

Meanwhile, Morse also took a leading role in developing and advocating the research uses of computers, starting even before World War II. This led him to an initiative in the introduction of centralized computing services at M.I.T. as founding director of the Computation Center, a post that he held for a decade starting in 1957.

Throughout his career, Morse was concerned with the public understanding of physics and its implications. Shortly after World War II he became the first director of the Atomic Energy Commission's Brookhaven National Laboratory, and out of that came his membership on what its founders called the Emergency Committee of Atomic Scientists, devoted to public education on atomic energy issues. At various times during his career Morse was a columnist for the *Cleveland Commercial*; an associate editor of *Technology Review*, *Physics Today*, the *Bulletin of the Atomic Scientists*, and *Science;* and chairman of the American Physical Society's Panel on Public Affairs.

Professor Morse was honored by election to the National Academies of Science and of Engineering, and he held several major awards from professional groups in physics and operations research.

Shatswell Ober, 1894-1985: Wind Tunnel Specialist

Shatswell Ober, '16, emeritus professor of aeronautical engineering whose pioneering work in wind tunnel design and testing made possible significant advances in aviation, died in a North Attleboro nursing home on September 2; he was 91.

Professor Ober returned to M.I.T. a year after his graduation in naval architecture to operate the Institute's first wind tunnel, which had been the first construction on M.I.T.'s Cambridge property. By 1922 he was back again, after a few years as a ship designer at Union Shipbuilding Co., Baltimore, as a research associate in wind tunnel aerodynamics. He joined the faculty in 1929 and retired 30 years later but continued as a lecturer well into the 1960s.

Professor Ober's teaching and research throughout this period focused on applied aerodynamics and aircraft propeller design, and on the design and construction of wind tunnels and instrumentation. His research in the wind tunnel field made possible many applications of this vital tool for aerodynamics research.

Walter F. Wagner, Jr., 1927-1985

Walter F. Wagner, Jr., '49, longtime editor-in-chief of *Architectural Record*, died suddenly at his home in Weston, Conn., on July 6. He was 58.

Wagner graduated in management at M.I.T., but in 20 years at *Architectural Record* he had become a force in the architectural profession through editorials, speeches, and committee activities. He joined McGraw–Hill Publishing Co., publishers of *Architectural Record*, upon graduating from M.I.T., working first on *Factory Management and Maintenance* and later on *Popular Boating* before finding his niche as executive editor of *Architectural Record* in 1965.

David J. Shapiro, 1955-1985

David J. Shapiro, '87, a student in aerodynamics and astronautics, died on June 19 in a glider accident during the New England Regional Gliding Championships in Vermont. He was 30.

Though he graduated with a degree in philosophy from Saint John's College in 1976, Shapiro was always intrigued by sailplanes. Before entering M.I.T. he was employed by the Schemp-Hirth Co. in West Germany, and he was considered one of the top glider repairmen in the world, according to Professor Robert J. Hansman, Jr., Ph.D.'82, who was also a participant in the New England championships.

Gerald M. Reed, Jr., 1910-1985

Gerald M. Reed, Jr., '34, who worked at the M.I.T. Sailing Pavillion as assistant sailing master and later sailing master from 1936 until retiring in 1976, died on July 5 following a short illness. He was 75.

Reed studied architecture at M.I.T. after graduating from Roxbury Latin School. But sailing was irresistable, and he went to work as the late Walter C. Wood's assistant at the Sailing Pavilion within two years of graduating. He became sailing master upon Wood's retirement in 1962. For 40 years, Reed helped teach sailing to at least ten generations of M.I.T. students and shared with Wood responsibility for a sports program that won wide acclaim in both the academic and sailing communities.

S. Paul Johnston, 1899-1985

S. Paul Johnston, '21, former director of the National Air and Space Museum at the Smithsonian in Washington, died at his home in Easton, Md., of pneumonia on August 9; he was 86.

Johnston joined the Aluminum Co. of America upon graduating in mechanical engineering. By 1935 he was editor of *Aviation* magazine, and by 1946—after a number of government assignments during and after World War II—he became director of the Institute of the Aeronautical Sciences. He joined the Smithsonian in 1964 and after retiring in 1969 became director of Chesapeake Bay Maritime Museum in St. Michaels, Md.

Joseph L. Klein, 1919-1985

Joseph L. Klein, '41, retired vice-president for engineering and development at Bird-Johnson Co., Walpole, Mass., died in Harvard, Mass., on August 3; he was 66. Mr. Klein worked at M.I.T. on metallurgical projects for a number of years beginning in 1948, and he later became for 14 years vice-president—operations at Nuclear Metals, Inc., Concord, Mass.

Donald B. Sinclair, 1910-1985

Donald B. Sinclair, '31, who rose in 39 years with General Radio Co. (now GenRad, Inc.) to become its chief executive officer and chairman of the Board before retiring in 1974, died at New England Medical Center on August 24; he was 75.

Sinclair was widely respected in the field of high-frequency electrical circuits and radar countermeasures. He had served on visiting committees at M.I.T. and was a frequent campus visitor, and he fulfilled many civic responsibilities in Concord and Boston. Sinclair worked as an M.I.T. co-op student at the New York Telephone Co., Western Electric Co., and Bell Labs, and while studying for his doctorate (Sc.D.'35) in electrical engineering he was a research assistant. He joined General Radio in 1936.

Deceased

The following deaths have been reported to the Alumni Association since the *Review*'s last deadline:

Edmund B. Kiely, '10; July 4, 1979; Reading, Mass.
Oliver D. Powell, '11; March 1985; San Marino, Calif.
Leon F. Marsh, '14; August 20, 1985; Framingham, Mass.
Shatswell Ober, '16; September 2, 1985; Arlington, Mass.
Allen D. Pettee, '16; September 13, 1985; Newton Centre, Mass.
Samuel Clayman, '17; September 13, 1985; Bela Cynwyd, Penn.
Mrs. William B. Hunter, '17; 1985; Meriden, Conn.
Kenneth M. Lane, '17; July 18, 1985; Miami, Fla.
Willard L. Pryor, '17; 1985; Manhasset, N.Y.
William A. Sullivan, '17; September 6, 1985; La Jolla, Calif.
Mrs. Ruth L. Wells, '18; June 9, 1983; Harrisburg, Penn.
Andrew Deane, '21; January 1, 1981; Naples, Fla.
Mark V. Hamburger, '21; August 8, 1985; Brookline, Mass.
S. Paul Johnston, '21; August 9, 1985; Easton, Md.
Eugene H. Kennedy, '21; 1985; Norfolk, Va.
Mrs. A. Warren Norton, '21; 1984; Milford, Conn.
Charles W. Scranton, '21; July 25, 1985; Pinehurst, N.C.
Earl H. Eacker, '22; September 5, 1985; Boston, Mass.
Theodore H. Elliott, '22; August 12, 1985; Manchester, Mass.
Paul C. Merrill, '22; July 2, 1985; Long Beach, Calif.
Charles H. Muhlenberg, Jr., '22; 1985; Wyomissing, Penn.
Augustus H. Hermann, '23; March 1985; Malden, Mass.
George I. King, Jr., '23; January 8, 1985; Montclair, N.J.
Joseph R. Maxwell, '23; 1985; Merion Station, Penn.
Raymond M. Meekins, '23; 1985; Roanoke, Va.
Mrs. Enid U. Colvin, '24; 1985; Cambridge, Mass.
Edward A. Milne, '25; June 2, 1985; San Fernando, Calif.
Robert F. Needham, '25; June 2, 1985; Concord, Mass.
Sumner B. Besse, Sr., '26; July 1985; Newport News, Va.
Joseph Y. Houghton, '26; 1985; Chevy Chase, Md.
William B. Millar, '26; August 29, 1985; Patagonia, Ariz.
E. Sterling Pratt, '26; July 16, 1985; Nashua, N.H.
George M. Cunningham, Sr., '27; August 19, 1985; Laguna Beach, Calif.
George E. Bass, '28; July 29, 1985; Santa Barbara, Calif.
Roland F. Beers, '28; July 9, 1985; Manchester, Vt.
Michael Cudahy Casserly, '29; September 8, 1985; Burlingame, Calif.
William J. Degnen, '29; August 21, 1985; Westfield, N.J.
Howard G. Pankratz, '29; July 19, 1985; Riverside, Calif.
Daniel Silverman, '29; June 2, 1985; Tulsa, Okla.
Janet P. Barnard, '31; December 28, 1984; Kennett Square, Penn.
Daniel S. Connelly, '31; July 15, 1985; Cleveland Heights, Ohio.
Carl D. Cordua, '31; May 20, 1985; Bronx, N.Y.
Antonio J. Galvache, '31; 1984; Madrid, Spain.
Donald L. Girard, '31; February 25, 1984; Austin, Tex.
George S. Gladden, '31; October 8, 1981; San Diego, Calif.
Donato A. Grieco, '31; July 12, 1985; Orchard Park, N.Y.
Richard H. Lukins, '31; 1982; Dallas, Tex.
Enio O. Persion, '31; March 7, 1985; Silver Spring, Md.
Donald B. Sinclair, '31; August 24, 1985; Boston, Mass.
John B. Tucker, '31; November 12, 1983; Spring Valley, Calif.
Neil M. MacLaren, '32; June 26, 1985; Hamilton, Mass.
Benjamin Shreve, '32; July 16, 1985.
John W. Westfall, '34; August 5, 1985; Barrington, R.I.
Frank Schaffer Besson, Jr., '35; July 15, 1985; Alexandria, Va.
C. Douglas Cairns, '36; July 5, 1985; Burlington, Vt.
Richard Halloran, '36; March 21, 1985; San Francisco, Calif.
Richard F. Harvey, '36; January 21, 1985; New Canaan, Conn.
Paul S. Morgan, '36; May 18, 1985; Naples, Fla.
John T. Smith, Jr., '36; June 7, 1985; Paget, Bermuda.
William P. Toorks, '36; May 23, 1985; West Yarmouth, Mass.
George W. Coleman, '37; 1985; Southborough, Mass.
Philip R. Scarito, '37; October 30, 1983; Douglassville, Penn.
Vernon G. Lippitt, '38; 1985; Rochester, N.Y.
George R. Bises, '41; October 23, 1984; 3963 Crans, Switzerland.
Emerson Evans Fawkes, '41; May 5, 1985; Arlington, Va.
Fred F. Flowers, '41; June 29, 1985; Findlay, Ohio.
Joseph Lester Klein, '41; August 3, 1985; Harvard, Mass.
Daniel G. Hulett, '42; June 17, 1985; Stamford, Conn.
William R. Lacy, '43; July 27, 1985; Orlando, Fla.
Andrew C. Peacock, '43; June 26, 1985; Rockville, Md.
Philip E. Daro, '46; June 29, 1985; Caldwell, N.J.
James A. Moore, '46; August 7, 1984; Port Jefferson, N.Y.
Raymond J. Schneider, '46; July 5, 1985; Baltimore, Md.
John H. Pomeroy, '49; March 14, 1985; Bethesda, Md.
Brahm Prakash Sekhri, '49; 1984; Bombay, India.
Walter F. Wagner, Jr., '49; July 6, 1985; Westport, Conn.
Rene G. Lamadrid, '50; November 21, 1984; Lake Forest, Ill.
Kent Moore, '50; July 30, 1985; Ledyard, Conn.
William H. Lewis, '51; June 3, 1985; Lansing, Mich.
Paul M. Starck, '55; 1985; Tulronweg, West Germany.
Anthony L. Galvagna, '56; March 25, 1985; North Andover, Mass.
William F. Dean, '57; June 27, 1985; Rockford, Ill.
Noel J. Hicks, '57; August 17, 1979; Ann Arbor, Mich.
Frederick Memmott III, '57; August 6, 1985; Madison, Conn.
Jay H. Long, '59; July 15, 1985; Mt. Akum, Calif.
Carlos F. Diaz-Alejandro, '61; July 17, 1985; New York, N.Y.
Allen A. Tunick, '63; August 2, 1985; Boonton, N.J.
Jon Leslie Fitch, '70; September 8, 1985; Indianapolis, Ind.
Edward S. Cooper, Jr., '76; June 2, 1985; Philadelphia, Penn.
Michael B. Johnson, '77; June 21, 1985; Seattle, Wash.
Anna O. Yau, '80; 1985; Goleta, Calif.
Christopher L. Hassig, '85; August 26, 1985; Conway, N.H.

ALLAN J. GOTTLIEB

Where Squares and Office Parties Mix

Jim Landau sent me quite an unusual package. I have often received mail marked fragile, but never before one mailed indestructible. Inside was a rope tied into a special knot and an accompanying problem. Although I do not as yet see how to present the problem without having each issue of *Technology Review* include an attached rope, I have had fun with the problem myself. I should also remark that this indestructible parcel seemed to get considerably better treatment en route than many unmarked packages I have received. Perhaps stores should try sending crystal in packages marked indestructible.

On a personal note, I am pleased to report that I have received tenure at NYU.

Problems

N/D 1. We begin with a computer-related problem from Al Weiss, who is given the coordinates of four points and wants to determine if they form the four corners of a square. No assumption can be made about the order in which the points are presented. For example, a square might occur as:
(8,8), (3,5), (2,4), (4,9).
Mr. Weiss seeks not just a solution, but an elegant algorithm.

N/D 2. Oren Cheyette offers us a seasonal problem. For an office party, each person is supposed to bring a gift for someone else. The recipients are assigned to givers by writing each person's name on a slip of paper, putting the slips in a hat, and having everyone draw a slip. Obviously, it's no fun if someone draws his own name. What is the probability that in an office of n people, no one draws his own name?

SEND PROBLEMS, SOLUTIONS, AND COMMENTS TO ALLAN J. GOTTLIEB, '67, THE COURANT INSTITUTE, NEW YORK UNIVERSITY, 251 MERCER ST., NEW YORK, N.Y. 10012.

N/D 3. Given a square matrix A (not necessarily invertible), satisfying
$AA = AA'$,
where the prime signifies transpose operator, Howard Stern wants you to show that
$A = A'$
using matrix operation only, i.e. without using normed algebras and approximating A by an invertible matrix.

N/D 4. Walter S. Cluett asks: What is the lowest number of current U.S. coins (1 cent through $1.00) for which there is no combination of coins that will equal in value a single coin? How many such quantities are there under 100?

N/D 5. Ronald Raines wants you to find functions f and g satisfying
$f[f(x)] = x$
$g[g(x)] = -x$
for all real values of x.

Speed Department

SD 1. Phelps Meaker has a pan with perpendicular ends and sloping sides. It is two inches deep and measures 8″ × 10″ on the bottom. What is the slant height of the sides if the capacity is 200 cu. in.?

SD 2. Jim Landau wants to buy a solid-state digital clock with a 12-hour LED display and wonders at what time would the largest number of LEDs be on? The smallest number?

Solutions

JUL 1. Find the smallest prime number that contains all 10 digits.

Dan Schmoker combined analysis with some computer work to obtain the following solution: The smallest 10 digit number with all digits different is 1,023,456,789. The sum of the digits in this number is 45 which is divisible by 3; hence the number is divisible by 3 and is not prime. In addition, any rearrangement of this 10-digit number would also be divisible by 3 and not prime. It follows therefore, that the smallest prime number that contains all digits must be an 11-digit number. The extra digit cannot be 0, 3, 6, or 9; otherwise the new number and any number formed by rearranging the digits would be divisible by 3, and hence not prime. The smallest number which contains all digits and could

possibly be prime is therefore the 11-digit number 10,123,456,789. The prime test should be started with this number. The numbers to be tested for prime are generated by rearranging the 11-digit number, minimizing the change in value by switching the right-hand digits first. The prime test is done by first generating a list of prime numbers. On my machine with 48K of memory the biggest list of prime numbers I could generate had a total of 9000 numbers with the highest prime number being 93001. By dividing with this list of prime numbers, the number 10,123,457,689 (the seventh number considered) was identified as a possible prime number. At this stage I began dividing by all odd numbers greater than 93001, continuing until the divisor exceeded the square root of 10,123,457,689. This last test only took a few minutes and showed that 10,123,457,689 was indeed prime.

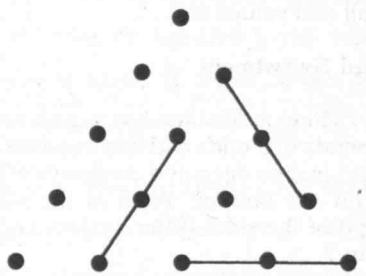
Also solved by Donald Savage, Henry Hirschland, Jonathan Sadick, N.C. Strauss, Ned Staples, P.V. Heftler, Richard Hess, and the proposer, Matthew Fountain.

JUL 2. The original Tower of Hanoi, first described in 1883, consisted of 64 golden disks, each of a different diameter, stacked according to size, with the smallest on top. The tower is to be restacked on one of two additional sites, moving one disk at a time off the top of one stack either to an empty site or to the top of the stack on one of the other sites, without ever placing a larger disk on a smaller. The original problem was to find the minimum number of moves to transfer the entire stack. The new problem is to calculate the location of each disk after 1,001 moves have been made using the optimum transfer procedure.

Rik Anderson found it easier to take a giant step forward and then 23 small steps back:
Identify the original stack as position A. If disk 1 is initially moved to position C, then disk 2 will initially be moved to position B at move 2, disk 3 will go to C at step 4, disk 4 to B at step 8, etc. Disk n will first move at move $2^{(n-1)}$, to position B if n is even, to C if n is odd. Following this rule, the first time disk 11 moves is at move $2^{10} = 1024$, to position C. At the previous move, number 1023, disks 1-10 would have reached position B. In getting to this position, disk 1 is at any position for two moves, disk 2 moves every 4th move, disk 3 every 8th move, and disk 4 every 16th. Disk 1's moves are in reverse sequence (A,C,B,A,C,B), as are all odd-numbered disks, while even-numbered disks visit the positions in sequence (A,B,C,A,B,C). Working these patterns backwards from step 1023, we would find at step 1001:
Position A - disks 1, 4, and 11 to 64
Position B - disks 2, 3, and 6 to 10
Position C - disk 5.

Also solved by Dennis White, John Prussing, Matthew Fountain, Ned Staples, Richard Hess, Winslow Hartford, and the proposer, Lester Steffens.

JUL 3. Define an n-triangle to be a collection of n(n + 1)/2 points regularly spaced into the shape of an equilateral triangle with n points on a side. Define a 3-line to be a line segment connecting exactly three adjacent points parallel to a side of an n-triangle. (The three adjacent points are said to be "covered" by the 3-line). For what values of n can all points of an n-triangle be covered by non-intersecting 3-lines?



This question appears to be difficult, and I consider the problem to be still open. Harry Zaremba shows that if one drops the requirement that 3-lines are parallel to a side of the triangle, then a solution exists for all
n = 9m and n = 9m − 1.
Dennis White, Richard Hess, and Winslow Hartford express the belief that (with the parallel requirement) no solutions are possible. Mr. Hartford notes that to have a multiple of three points, we need
n = 3m or n = 3m − 1,
and indicates that an inductive proof should be possible.

JUL 4. A manufacturer makes all possible sizes of brick-shaped blocks such that the lengths of the edges are integral multiples of the unit of length, and that the number of units in the total length of the twelve edges of the block is equal to two-thirds of the number of units of volume in the block. What sizes does he make?

The following solution is from Howard Stern:
AB:CD × E = FG:HI
Since the smallest value that AB can assume is 12, it follows that E cannot be larger than 4. It also cannot be 1 because then the times would be the same. Therefore, E must be 2, 3 or 4. This forces A to be 1. In addition, C, F and H must be 2, 3, 4 or 5 for the times to make sense. Since A = 1, E cannot be 2 because then F would also have to be 2. E cannot be 4 either because then B would have to be 2 or 3, and it would be impossible for C, F and H to be 2, 3 or 5. Therefore, E must be 3. This forces C, F and H to be 2, 4 or 5, and D and I must be 6, 7, 8 or 9. From the multiplication by 3, the only possibilities are D = 6 and I = 8, or D = 9, and I = 7. These restrictions leave only a few feasible times to try and the only one that works is: 18:49 × 3 = 56:27.

Also solved by Avi Ornstein, Dennis White, Frank Carbin, Harry Zaremba, Henry Hirschland, Matthew Fountain, P. Michael Jung, P.V. Heftler, Richard Hess, Steve Feldman, Winslow Hartford, and the proposer, Phelps Meaker.

JUL 5. An ideal pulley system supports a bucket of water on one rope and a monkey on the other. The bucket and monkey are in static equilibrium and at the same vertical level. Suddenly the monkey began climbing up its rope. Describe the motion, if any, of the bucket.

Everyone agrees that the bucket follows the monkey exactly, independent of the mechanical advantage of the pulley system. The argument goes as follows: The monkey's change of state from rest to an upwards velocity implies acceleration which requires force. The reaction force is tension xT in the monkey's rope (where x is the pulley's mechanical advantage with respect to the monkey). The dynamical response of the bucket to the force xT is identical to the monkey's, so that the bucket and the monkey accelerate upwards together. After the monkey's acceleration stops, it continues to climb at some velocity v, and so does the bucket.

Solutions were received from Richard Hess (who attributes the problem to Lewis Carroll), William Moody (who first heard the problem 58 years ago in his 8.01 freshman physics course, taught by Prof. "Hard-Boiled" Lewis Young), Ronald Martin, Winslow Hartford, Harry Zaremba, Dennis White, and the proposer, Bruce Calder.

Better Late Than Never

1980 FEB 3. Warren Himmelberger suggests the solution (33231302212011003)

1983 APR 4. Dick Allphin reports that a similar problem has appeared in *The New York Times*. Furthermore, Mr. Allphin believes that, when travelling in the rain, "for minimum soaking it pays to make haste."

Y1984 Rik Anderson has noticed that $16 = 4^{1/8/9}$.

1984 APR 2. John Coleman has responded.

1985 F/M 3. John Smith found that x = (sin 60)/(sin 75)a.

F/M 4: Phelps Meaker noticed that this problem was also F/M 4 in 1984. An unintentional yearly problem!

APR 1. Michael Jung has responded.

APR 4. Michael Jung has responded.

APR 5. Frank Carbin has responded.

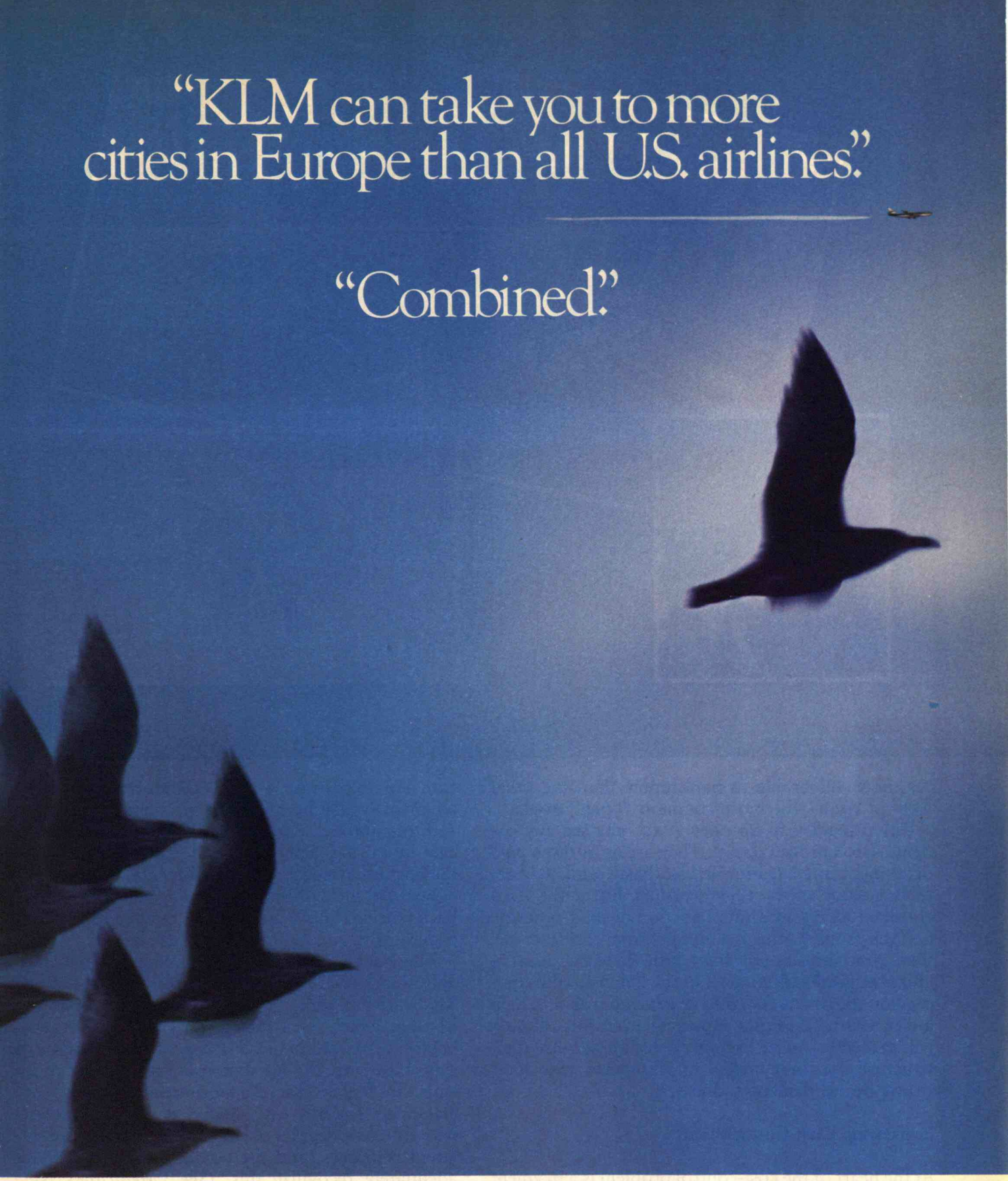
M/J 4. Jim Landau has responded.

July SD 2. Ben Feinswog wants to play the ♥Q before the ♦K and gives a try for the contract, if West is void in hearts.

Proposers' Solutions to Speed Problems

SD 1. $2(2)^{.5}$.

SD 2. 10:08 (or 10:08:08 if the clock has seconds). 1:11 (or 1:11:11).



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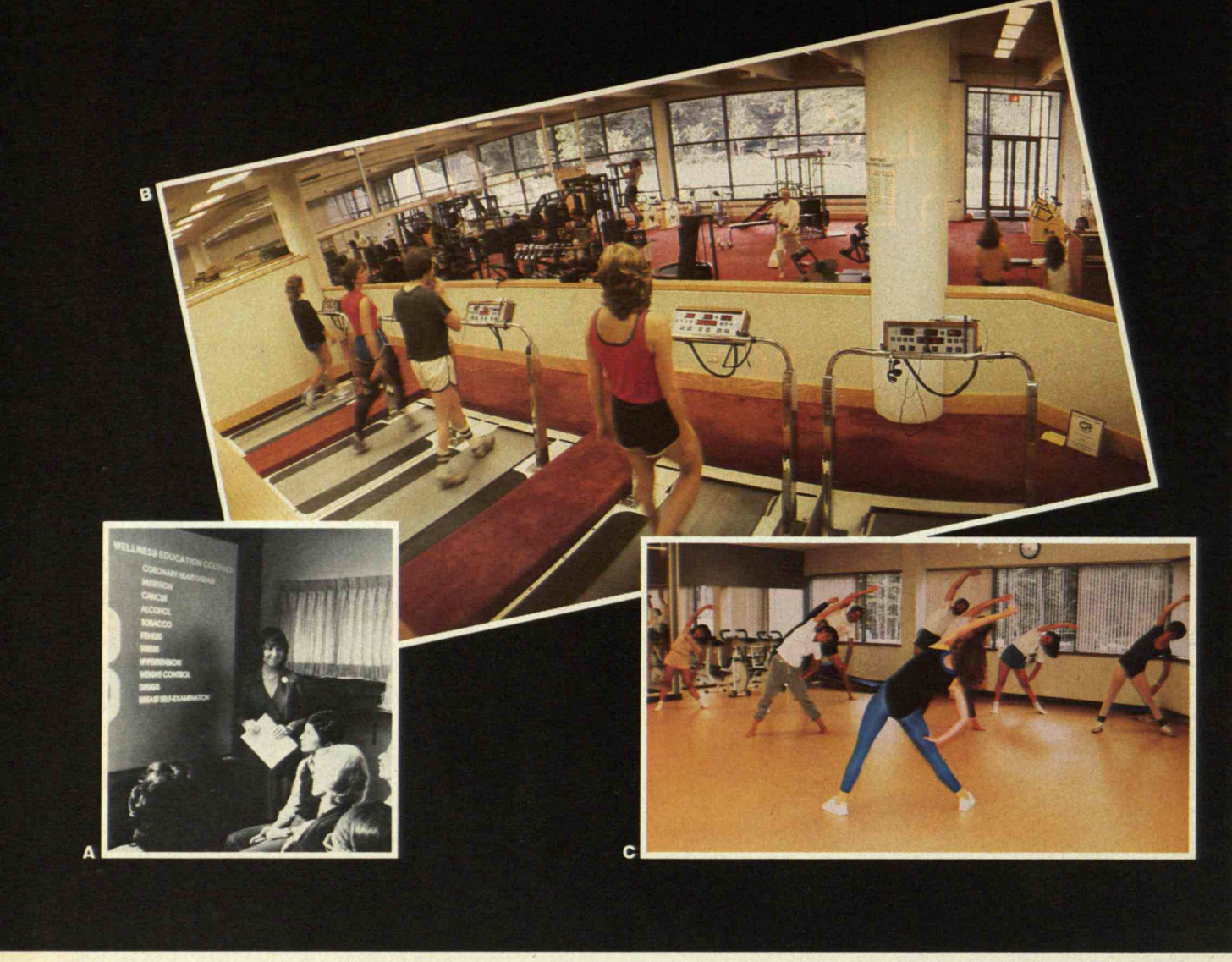


are more vulnerable to bankruptcy than the other form of HMO—the more common "open" model.

The providers in an open HMO may see any patient, HMO enrollee or not. They are most often paid on a discounted fee-for-service basis, and they receive a share of the HMO's profits. But if the HMO enrollees represent a small portion of their practice, or if the profit sharing is a minor part of their income, these practitioners will have little incentive to minimize hospitalization rates. In the long run, the competition these new HMOs have generated should help lower health-care costs. However, even closed HMOs will probably not be the only solution because their structure does not appeal to employees who have strong ties to their own doctors.

Legislating Cost Containment

At the heart of the cost-control problem is a payment system that rewards suppliers for oversupplying and motivates consumers to overconsume. The only true solution is to change this system. One way to do that is by using closed HMOs, which alter the incentives for both providers and consumers of health care. Another strategy is to legislate changes in the payment system by putting a cap on hospital costs. A third approach is to change the demand for health care by raising deductibles and employees' share of the cost of corporate health insurance.

Because each of these strategies has some drawbacks, firms should use them in tandem along with programs to encourage good health habits.

The federal government has already taken a laudable step forward by setting up the DRG system for Medicare payments. In part because of the DRG legislation, which went into effect in 1983, hospitals have experienced reduced occupancy and lengths of stay. However, the legislation is not without problems. In theory, the diagnosis-related groups are classes of illnesses with similar costs. Yet patients with different degrees of the same illness require different resources, and the DRG legislation does not adequately recognize this. (*See "Medicare's New Payment Plan," page 50.*)

Another problem with the DRG system is that it motivates hospitals to inflate diagnoses to higher-paying DRGs. For instance, it tends to encourage doctors to put patients with stomach problems in groups

Despite extensive publicity about corporate efforts to promote good health, few companies have well-designed programs. Control Data Corp.'s STAYWELL program is an exception. It provides employees with a range of courses in fitness, nutrition, smoking cessation, weight loss, and the moderate use of alcohol and other drugs (A, D, and E). Instead of helping employees change bad habits, many other companies stress only the fitness aspect of good health, holding exercise classes and providing fancy Nautilus equipment (B and C).

such as "other gastrointestinal operations" instead of in well-defined categories such as appendectomy. This is because the costs for miscellaneous diagnoses are not as fixed and can more easily be inflated. The fact that the complexity of diagnoses has greatly increased since the DRG system began may be another result of this phenomenon: more complex diagnoses generate higher DRG payments. Although DRG reimbursement is accompanied by utilization reviews, there is no reason to believe that they will be better than the ineffective reviews of the past.

In 1982, the Massachusetts legislature approved an innovative payment system that avoids these weaknesses. The new law puts a limit on every hospital's annual billings, which are allowed to grow only at a fixed rate. That annual allowance or cap, which is based on each hospital's experience when the law first went into effect, is independent of its current volume or costs. Under this system, hospitals have little incentive to increase volume or inflate diagnostic groups. Instead, they have every incentive to lower their costs below the fixed cap.

The Massachusetts business community lobbied for this approach to containing costs because it ends the cost-shifting practices made possible when the federal government bases payments on DRGs and the private sector pays for hospital costs or charges. Under this system, each insurance company pays a share of a hospital's annual cost allowance based on how much the firm's clients have used the hospital's services. For example, if the hospital has a total allowance of $50 million and Blue Cross/Blue Shield clients use 20 percent of the services, then Blue Cross/Blue Shield will pay $10 million. Health-care costs are more predictable under this system than they are under other payment systems.

However, this approach, too, has flaws: it motivates hospitals to inflate their costs in their first year, and it punishes hospitals that go into the program with low costs due to lean operations. Moreover, the efforts of business leaders in other states to install this system have backfired, mainly because they have been unable to forge effective political alliances.

The most effective way to control health-care costs is to raise insurance deductibles to between $500 and $1,000. A recent Rand Corp. study has shown that those who are fully insured spend 50 percent more than those who are uninsured for their first

PHOTOS: CONTROL DATA CORP., MICHAEL MARKS, APOLLO COMPUTERS

$1,000 of health care.

Most benefit officers blanch at the idea of such "catastrophe insurance"—so-called because expenses over $1,000 are frequently for catastrophic illnesses. They claim that employees won't accept such a high deductible, and that it will affect employees' health because some will not seek care if they have to pay for it themselves. They also argue that it is regressive because lower-paid employees will feel the pinch of the high deductible more than higher-paid ones.

These objections are not compelling. First, employees will indeed accept catastrophe insurance, as programs in a number of companies have shown. One Fortune 500 firm in the Midwest recently adopted a health insurance program that offers its 3,400 salaried employees two choices: health insurance with a $1,000 deductible or enrollment in an approved HMO. The majority has chosen the high-deductible policy because in exchange for the reduced health-care benefits, they receive a $1,300 credit to spend on other benefits.

Young Engineering of South Carolina adopted a similar plan a few years ago, offering employees incentives to choose higher-deductible policies. Many of the firm's employees chose the $1,000-deductible plan. The company's overall insurance costs were lower in 1984 than in the two years before the plan went into effect, and there were no effects on employee morale.

The favorable results these firms have encountered in shifting to catastrophe insurance are not startling. Much more surprising is the fact that low-deductible health insurance exists at all. Such coverage is *not* insurance; it is a payment plan. Most insurance protects people against large risks such as the destruction of their homes. Health insurance, in contrast, pays for all expenses. It's like buying home insurance for routine painting, plumbing, and other maintenance jobs.

Low-deductible health insurance became common because it enabled both employees and employers to pay for insured health expenses on a pretax basis. Flexible benefit plans provide the same kind of pretax advantage. However, many employees prefer to invest their pretax dollars in company retirement accounts rather than in extra health-care coverage.

Catastrophe insurance need not be regressive. The deductible can be linked directly to salary; Xerox, for instance, sets a deductible equal to 1 to 2 percent of salary. The policies should also include a lifetime maximum linked to income—such as $20,000 in total employee out-of-pocket costs. Such a system would help employees with chronic catastrophic illnesses, such as diabetes and arthritis. In such cases, the high annual deductible, which is designed to discourage unneeded medical care, could be eliminated.

The argument that catastrophe insurance will lead to poor health because employees will not want to pay for care is based on the misleading assumption that maintaining good health and paying for health care are related. In fact, most U.S. medical care now focuses on curing illness rather than maintaining health. Indeed, a ten-year study by the Rand Corp. shows that the health of people with high-deductible insurance is as good as the health of people whose low-deductible insurance has paid for an abundance of health care. Most of the serious diseases today are caused by poor habits: smoking, eating too much and the wrong kinds of food, and old-fashioned sloth. As now designed, health insurance does nothing to encourage people to change these habits.

The Business of Promoting Good Health

Despite the onslaught of publicity about corporate efforts to promote good health, few firms have well-designed programs. Too often, such programs are run by "true believers" who are unresponsive to the needs of employees. In firms whose top managers are cursed by the disease of alcoholism, drug-abuse programs prevail. If a company's chief executive officer used to be a middleweight boxer and is middle weight no longer, fitness programs abound. Rationales for these programs are often vacuous—"better morale" is a common one—and results are unmeasurable.

Perhaps the fuzziness of purpose, low funding levels, and seemingly random choice of program offerings are justifiable. After all, the effects of such programs on health-care costs are unclear—as is the success in changing bad habits. After all, some of the habits these programs try to instill may not be so desirable themselves: the effect of vigorous exercise on long-term health, for instance, is hardly unambiguous. Furthermore, some critics consider health programs an invasion of employees' privacy—a dose of unnecessary corporate paternalism.

Despite these legitimate concerns, I believe that corporate health programs are not only justifiable

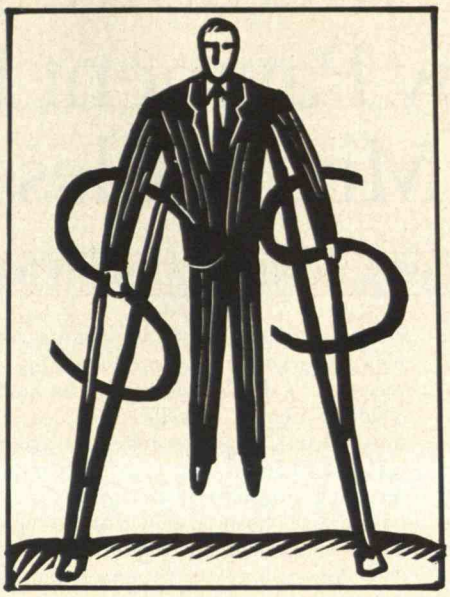
but essential. According to the Department of Health and Human Services, most of the $387 billion Americans spend on health care yearly pays for treating diseases related to six behavior-related factors: smoking, high blood pressure, high cholesterol levels, nutritional defects, alcoholism, and lack of fitness.

Because the benefits of avoiding diseases are great and the costs of health programs are low, such programs are cost-effective even if their success rate is modest. Furthermore, employee enthusiasm is likely to be high, since many people feel they're doing a poor job of maintaining their health.

The STAYWELL program of the Control Data Corp. (CDC) is a good example of effective efforts to promote good health. STAYWELL provides confidential behavioral health screening and health-hazard appraisals. Employees can then choose from among a range of courses in fitness, nutrition, smoking cessation, weight loss, and the moderate use of alchohol and other drugs. Employees help make the work environment more healthful by enforcing no-smoking rules and making sure company vending machines offer fresh fruit.

In addition, CDC has developed a computer-based instruction program that is individualized (it uses each person's name) and supportive in tone. The computer is programmed to help each employee design a health program tailor-made for his or her personal habits and needs. The computer also keeps track of each person's accomplishments, modifying his or her program accordingly. CDC offers STAYWELL free to 22,000 employees and spouses. Employee enrollment has ranged from 65 to 95 percent, and many participants say that the program has been highly beneficial in changing behavior patterns.

Firms should coordinate such health programs with other strategies for containing costs. Insurance plans could differ depending on employees' health risks. For example, smokers could pay higher premiums, face much higher deductibles and copayment, or be denied insurance for smoking related diseases such as lung cancer. Of course, since factors other than smoking can cause these diseases, there should be escape clauses for those who can show that they did not smoke. Because the relative risks of different health habits are fairly well documented, the costs of such insurance could easily be computed.



Most health insurance does nothing to encourage people to change bad habits.

Most employers pale at the thought of offering risk-related health insurance. A more palatable alternative may be catastrophe insurance, which by its nature rewards those with healthy lifestyles because they are less likely to incur the costs of the deductible.

Taken together, these strategies could cause a massive reduction in the health-care system and its costs. Hospitals would experience the most dramatic effects. Many small, inefficient hospitals would close because they would be unable to compete. Large hospitals would shrink, and many might join regional or national chains to achieve some economies of scale. Outpatient and nursing-home facilities would grow, providing care for those who in the past were cared for in hospitals. Hospital officials would increasingly weigh the cost-effectiveness of expensive new medical technologies such as nuclear magnetic resonance (NMR) imaging, which is used to diagnose cancer and other diseases. More new technologies would be developed for use in the growing outpatient and nursing home market. Electrocardiographs for the doctor's office and portable blood-pressure monitors are two new devices that are already meeting the changing needs of the health-care industry.

By and large, these changes will improve the health of most Americans while helping to stabilize the cost of health care in this country.

FURTHER READING

☐ Herzlinger, Regina, "How Companies Tackle Health Care Costs." *Harvard Business Review,* July/Aug., Sept./Oct. 1985, Jan./Feb. 1986.

REGINA HERZLINGER is professor of business administration at the Harvard Graduate School of Business. She graduated from M.I.T. with an economics degree in 1965.

Medicare's New Payment Plan: A Mixed Blessing

BY DOUGLAS A. CONRAD AND GILBERT S. OMENN

In 1983, the federal government made a fundamental change in the way it reimburses hospitals for the care of Medicare patients. Instead of paying hospitals whatever they say their costs or charges are, the government now pays a fixed sum for a particular diagnosis. Each diagnosis is included in a "diagnosis-related group" (DRG), and that DRG reflects not only the main illness but also complications. For instance, a patient admitted to the hospital for treatment of a heart attack but no other cardiovascular complications would be included in one DRG, while a patient with complications such as heart-rhythm disturbances or congestive heart failure would be included in another, higher-paying DRG.

This method of reimbursement provides hospitals with much-needed incentives to keep their costs down. It has already reduced the length of time patients stay in hospitals and thus is a major step toward economic reform. But it is not without some serious flaws. The new system may actually increase the number of hospital admissions in some cases and shift some types of care to outpatient settings without diminishing their cost. It may also encourage some hospitals to avoid treating acutely ill patients with limited means. And finally, the new system will have a mixed effect on technological innovation, encouraging hospitals to adopt cost-saving technologies while motivating them to continue investing in expensive "magnet" technologies of questionable value.

A Bias Against the Severely Ill

The severity of illnesses among patients within a given DRG varies considerably. Since the government bases payments to hospitals on the average level of resources required for each DRG, hospitals are, in effect, penalized for treating more complex and severely ill cases. According to a recent study, Rush-Presbyterian-St. Luke's Medical Center, a well-known teaching hospital in Chicago, suffered an average loss of $10,567 for each Medicare patient receiving nonsurgical intensive care. In contrast, the hospital gained an average of $578 per patient not requiring intensive care. Among patients who underwent coronary-bypass surgery, the hospital realized an average profit of $10,858 for those not requiring intensive care. But it lost $674 for every patient with the same diagnosis and treatment who did require intensive care.

The new Medicare system seems to encourage the use of surgery over nonsurgical treatment. This is because hospitals are now reimbursed for more than the surgery actually costs.

To avoid such losses, hospitals somehow will have to "streamline" the care of acutely ill patients. As a complementary strategy, hospitals will seek payments for the more profitable diagnoses to cover such losses. Many private hospitals may simply avoid admitting severely ill Medicare patients, "dumping" them instead on goverment-funded municipal hospitals. Since the resources of many public hospitals are already badly strained, this bias could well disenfranchise the acutely ill poor and elderly from the benefits of sophisticated medical care.

An increased focus on the severity of illness will also encourage hospitals to invest in sophisticated information systems that identify the severity of illness more precisely. A growing number of hospitals, for instance, are buying software that classifies individual cases by the stage of disease or by their patient-care requirements. Such systems will replace traditional billing systems that do not contain such information.

The new system also appears to encourage surgical rather than nonsurgical treatment. DRG payments are based on actual hospital charges in recent years. However, these figures are already outdated and do not reflect the shorter lengths of stay many types of surgery now require. Hospitals are being reimbursed for a higher amount than many surgical procedures now cost. For instance, payments for treating patients with heart disease nonsurgically are about one-third those for treating the same patients using coronary-bypass surgery. Hospitals therefore have an incentive to perform such surgery, even though many (perhaps most) patients do not need it.

Even worse, many of the bypass operations are performed in hospitals that do too few cases to be really proficient. Complications may result that not only harm the patient but also increase the resources devoted to caring for that patient. Exacerbating this bias is the structure of fees for physicians, who are paid separately. A recent Medicare study shows that doctors receive $197 per hour for surgical procedures versus $50 per hour for nonsurgical treatments. Including all physician services in the DRG prices for inpatient care would eliminate this disparity. Such a step would ensure that doctors share the hospitals' interest in keeping costs down.

DOUGLAS A. CONRAD is director of the graduate program in health services administration at the University of Washington's School of Public Health and Community Medicine. GILBERT S. OMENN is dean of the School of Public Health and Community Medicine.

The new plan encourages hospitals to adopt some cost-saving techniques but also to invest in expensive diagnostic technology.

Under the new system, teaching hospitals are still reimbursed for their direct costs of providing education, which mainly include the salaries of interns and residents. Since the 7,000 hospitals in the United States include only about 400 teaching hospitals, most hospitals view the $1 billion now going to teaching institutions as an undesirable claim on a dwindling pool of health-care dollars.

Sen. David Durenberger [R-Minn.] has proposed funding medical education from a "discretionary" budget allocated by the states. However, under this proposal, federal contributions would be cut by about 10 percent. Adopting this plan would also mean that such funding could more easily fall victim to efforts to reduce the federal budget deficit.

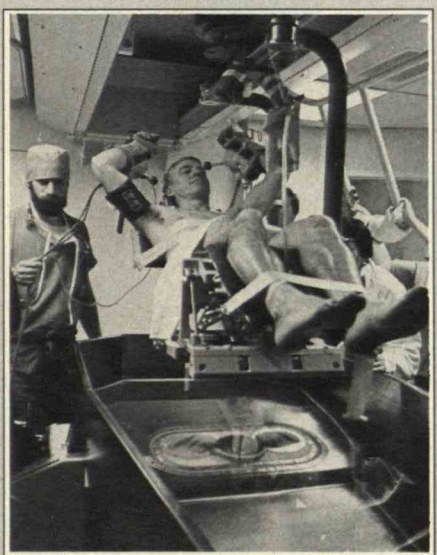
We believe that payment for patient care and rigorously accredited medical education should be linked. Patients benefit from the intellectually challenging environment for medical students, residents, and attending physicians in a teaching hospital. When the transition to 100 percent DRG payment rates is completed in 1988, the direct costs of medical education should be built into higher DRG rates for teaching hospitals.

The Technological Incentive

Because hospitals can gain higher profits by doing surgery, we can expect to see an increase in new (and costly) technologies for the operating room. However, DRGs have also encouraged a number of cost-saving technological innovations as alternatives to conventional surgery. For example, a device developed in Germany, called the Dornier extracorporeal shock-wave lithotripter, breaks up kidney stones using shock waves rather than surgical incision. The hospitalization time for lithotripsy is less than one-half that of alternative minor surgical procedures, and less than one-third that of major kidney stone surgery. Hence, hospitals may be more inclined to use lithotripsy, when feasible, for inpatient and outpatient care.

Banking on the initial success of the Dornier device, a few American companies have developed new lithotripters that are much less costly but just as effective as the German product. By lowering the DRG payment for this technology, the federal government can make sure that the first-generation West German product is not insulated from U.S. competition.

PTCA—or percutaneous transluminal coronary angioplasty—is another new technology that promises significant savings in cost. PTCA is a nonsurgical alternative to coronary-bypass surgery for heart patients with a blockage in their coronary arteries. It uses a catheter to overcome the obstruction in the clogged artery. The new DRG payment system gives hospitals an incentive to use this new procedure because its cost is about 15 percent less than bypass surgery.



The plan does prompt hospitals to adopt less expensive alternatives to certain forms of surgery. Here a patient is treated for kidney stones by a lithotripter, a device that uses shock waves to break up the stones instead of surgery.

However, some provisions in the DRG system may inadvertently discourage some hospitals from using PTCA. For instance, if PTCA doesn't work for a given patient, bypass surgery may still be required. In such cases, the hospital will be paid only for the bypass operation even if PTCA was performed during the same hospital stay. That lowers the hospital's incentive to try angioplasty before bypass surgery. It may also encourage hospitals to admit heart patients twice, once for a PTCA and again for a bypass, which of course increases the overall costs of health care.

The DRG system also indirectly encourages hospitals to acquire expensive diagnostic technologies, such as nuclear magnetic resonance (NMR) imaging and CAT scans, both of which scan for abnormal tissue in the body. These machines can cost close to $1 million each, and their value in diagnosing disease remains unclear. Yet because the DRG system induces hospitals to discharge patients sooner, lowering occupancy rates in the short run, more hospitals will feel impelled to acquire these desirable technologies to attract physicians and, with them, patients.

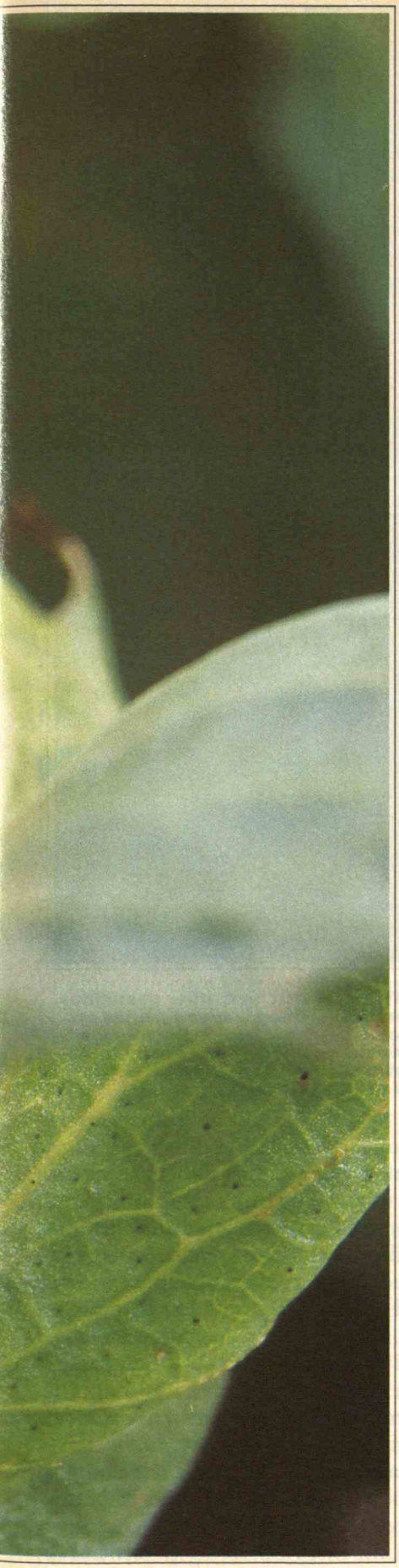
Because it is such a shock to the status quo, the DRG system is being phased in over four years. For now, the government continues to pay the costs of capital—interest, depreciation, and return on equity for investor-owned hospitals—separately based on a hospital's actual costs. This again encourages hospitals to spend money on medical equipment and buildings rather than relying on human labor and "intellectual software" — that is, information and brain power. Many hospitals will be more likely to buy expensive machines instead of making much-needed innovations in managing patient care. For instance, many hospitals need to better coordinate patients' discharge plans with home health and nursing-home services.

DRGs do provide a strong incentive for hospitals to combine all their important resources (length of stay, routine and intensive care, x-rays, laboratory tests, and operations) to minimize the resources used per hospitalization. However, integrating several levels of health services—office visits and hospital outpatient and inpatient care—could yield still greater economies. Health maintenance organizations (HMOs), which provide a full range of services in return for a fixed premium, have dramatically demonstrated this fact: their costs are 10 to 40 percent less than those of the traditional health-care system.

The federal government should contract with more HMOs and networks of doctors

Continued on page 76

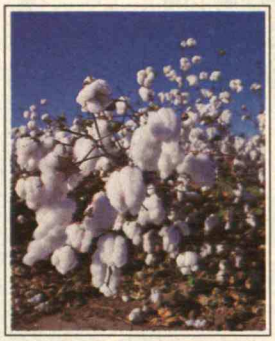
PHOTOS: MICHAEL LUTCH, MASSACHUSETTS GENERAL HOSPITAL



We must set up a comprehensive federal program to promote more benign and effective pest controls.

Getting Off the Pesticide Treadmill

BY MICHAEL DOVER



HUMANITY has always had to contend with microbes, plants, and animals that threaten our health and comfort, damage our property, harm our domesticated animals, and encroach upon our food supply. Only in the last four decades has the relationship between people and pests shifted dramatically, raising our expectation that the battle could be won. This revolution—for it is nothing less than that—began during World War II with the development of DDT, the first of the synthetic organic pesticides.

With its low toxicity to humans and high toxicity to insects, DDT seemed to be a miracle chemical—the perfect pesticide. It clearly was safer and more consistently effective than the highly toxic arsenicals, heavy metals, nicotine, and cyanide used to control insects earlier. DDT had other apparent assets as well, including persistence in the environment and toxicity to a broad spectrum of insect species. And the chemical worked: it prevented millions of deaths from lice-borne typhus during and immediately following the war, and it virtually eliminated malaria, carried by mosquitoes, from large parts of the world. Together with the later discoveries of a burgeoning chemical industry, DDT also revolutionized agriculture. Because farmers no longer had to worry as much about pest control, they could concentrate on reducing labor and using fertilizers, irrigation, machinery, and high-yielding crop types. These changes have profoundly affected the world's economies and societies.

Many insects, such as this tobacco budworm munching on a cotton boll, have become major pests only after chemicals have killed their natural predators. Better pest-control methods could reduce pesticide use by 50 to 75 percent.

PHOTOS: RUNK/SCHOENBERGER, ALAN PITCAIRN, FROM GRANT HEILMAN

Malaria, once almost wiped out, is again becoming a serious health concern in the tropics because mosquitoes have grown resistant to the effects of DDT and other pesticides. Chemical companies are now finding it ever more difficult and costly to develop new types of pesticides.

Yet while DDT initiated the new age of pest control, it also spawned a new environmental consciousness. For DDT became the principal villain in the problems that emerged as our society began to rely almost exclusively on chemicals for pest control. Soon after the chemicals were developed, questions about their effects on human health and the environment, and about pests' resistance to their effects, began to surface.

These concerns have proven to be well founded. Many species of insects no longer respond to the effects of chemical pesticides. World pesticide use has increased dramatically—U.S. production rose from 464,000 pounds in 1951 to 1.5 billion pounds in 1980—but the percentage of crops lost to pests has apparently not declined. Insects consume as much as one-third of the Asian rice crop annually, and in the United States losses of fruit and vegetable crops from plant diseases may exceed 20 percent. Malaria is again becoming a serious health concern in the tropics. And reports of pesticide contamination of water and food supplies surface regularly. Clearly, just pouring on more chemicals is no answer.

If agricultural productivity is to meet rising food demand and insect-borne diseases are to be controlled in tropical areas, safe, effective pest control must become a global concern. And indeed, better pest-management techniques stand ready to reduce pesticide use by as much as 50 to 75 percent. Yet

PHOTOS: GRANT HEILMAN; SHOSTAL ASSOCIATES

Farmers often must apply more and more chemicals just to keep from losing everything.

our society continues to rely almost solely on chemicals. We are caught in a "magic-bullet" approach, continually trying to develop new pesticides to stay one step ahead of disaster.

I believe we can better manage pests by carefully deciding when, where, and how much pesticide to use. We must also employ many different technologies, including biological controls, as part of a long-term strategy. The key is to base the choice of technology on an understanding of how pests interact with one another and the environment. That will be possible only if we abandon our unsystematic efforts and set up a comprehensive federal and state research and advisory program to help farmers and others manage pests safely and efficiently.

Problems with Pesticides

By design, pesticides are biologically active and, in most cases, toxic. Thus, they pose potential risks to human beings. However, 40 years of experience have provided remarkably few consistent results on how these materials affect people. Of most immediate concern is acute poisoning—sickness and death from one or a few exposures to a chemical. Although scientists debate the incidence of such poisonings, estimates of 10,000 deaths and 400,000 illnesses per year worldwide are probably close to the mark. Continuing exposure to low levels of pesticides also puts farm workers at risk of tumors, reproductive disorders, birth defects, and long-term illnesses, including cancer.

Those who handle pesticides are not the only group at risk. Pesticide residues in food and drinking water may accumulate in human tissues, causing cancer and other diseases. Especially disturbing are the residues' effects on infants and children, a subject scientists and regulators have neglected. Because so many people are potentially (and involuntarily) at risk, dietary exposure remains a powerful social and political issue. The result has been public pressure to ban certain pesticides. In the 1970s the EPA banned many of the "organochlorine" insecticides—DDT and its relatives—from general use because of public outcry over their residues in humans and wildlife. Residues of these chemicals in food have since dropped significantly.

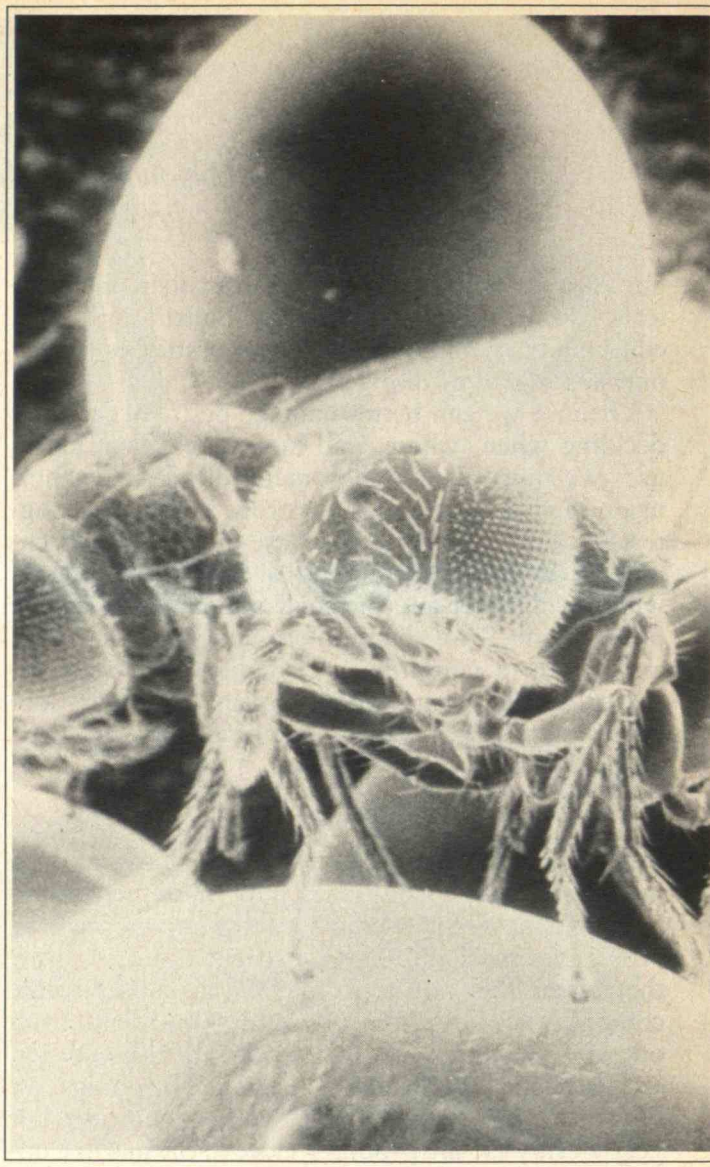
Yet the ecological and health effects of pesticides continue to plague us. The chemicals that have replaced the organochlorines—such as the organophosphates, which include malathion and parathion, and the carbamates, which include carbaryl and aldicarb—are less persistent. But they are also more water-soluble and therefore more likely to reach aquatic and marine organisms. Many of these materials are more acutely toxic as well, posing a greater hazard to farm workers in particular. Moreover, some do not break down as quickly as scientists had originally thought, making long-term effects on "nontarget populations" a serious possibility.

Heavy reliance on synthetic pesticides has also spawned problems that jeopardize effective pest control itself. For example, many species of pests are becoming immune to the effects of these chemicals. From 1970 to 1980 the number of such resistant species of arthropods—insects, mites, and ticks—jumped from 224 to 428. The numbers of resistant species of rodents, bacteria, fungi, and weeds are also increasing. Resistance threatens the future of potato farming in the Northeastern United States and cotton growing in several parts of the world. In the tropics, resistance also impedes control of insect-borne diseases: the chemical industry can no longer develop new pesticides as quickly as pests develop immunity.

Another problem stems from the fact that both on farms and in natural habitats, predators, diseases, and competitors keep pests in check. Pesticides may disrupt this balance so that once-harmless species grow numerous enough to become pests. The burgeoning of the tobacco budworm on cotton crops in Texas and Mexico, and the explosion of spider mite populations on apples in the Pacific Northwest, are among the best-known examples. At worst, these secondary, "induced" pests cause more trouble than the pests that the chemicals were originally designed to control. Furthermore, because natural checks have been eliminated, primary pest populations may rebound quickly to even greater numbers after a pesticide wears off.

Resistance, secondary pest outbreaks, and resurgence often lead farmers to apply more and more chemicals to keep from losing everything. Just such a "pesticide treadmill" devastated cotton growing in parts of Central America in the 1950s and 1960s. In little more than 10 years, the number of insect species requiring control went from two to eight, while the number of pesticide applications per growing season increased from fewer than five to twenty-eight. Pest-control costs eventually accounted for

The U.S. Department of Agriculture is developing a program to permanently introduce this South American wasp to combat the Colorado potato beetle. The beetle threatens to wipe out Northeastern potato farmers because it has become resistant to all available pesticides. Here the wasp, *Edovum puttlerum*, injects its own eggs into those of the potato beetle. A few weeks later mature wasps emerge, having killed off the developing beetles.



half of all production expenses.

Pesticides present an ever-widening dilemma. While they have opened up many possibilities for improving agriculture and public health, they have closed others, making us extremely dependent on chemicals for continued survival. Biological controls, which are more benign and often more effective, are crucial to any strategy that would relieve us of this dependence.

Putting Nature to Work

In agriculture and other managed ecosystems, people have long used "natural control," a form of biological control that involves conserving pests' natural enemies. Farmers keep these beneficial species active by carefully selecting their pesticides and by judiciously timing planting, harvesting, and pesticide use. For example, apple growers control spider mites by protecting other mites that prey on the pests. To do this, growers avoid insecticides and fungicides that are toxic to the beneficial mites, and often maintain ground cover at the base of trees to protect the beneficials during winter.

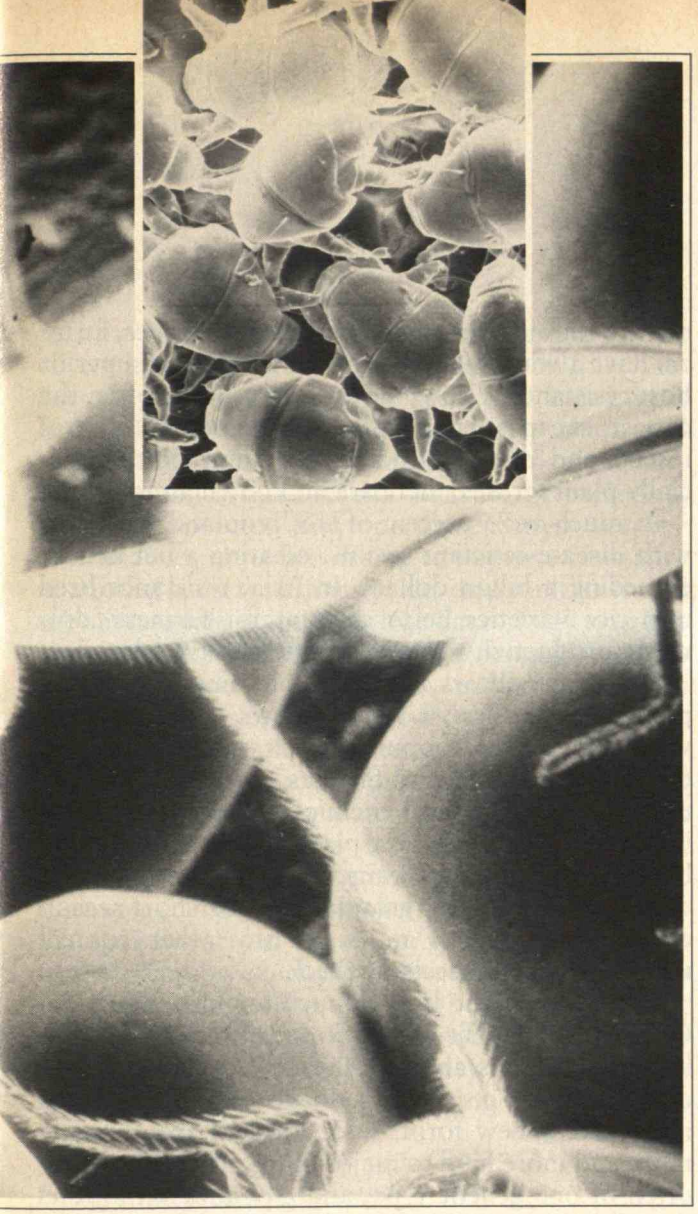
Paradoxically, the future of natural pest control depends partly on developments in pesticide chemistry. For instance, new insecticides might target key pests more specifically, allowing predators and parasites to survive to suppress secondary pests. Or newly designed chemicals might have a composition that allows only beneficial species to detoxify them. However, innovations may be possible only if scientists find ways—using genetic engineering, for example—to synthesize complex molecules cheaply.

A second form of biological control, "inoculative release," entails introducing pests' natural enemies and making them a permanent part of the ecosystem. One of the earliest examples of such an effort occurred in 1888, when California imported the vedalia lady beetle to feed on the cottony-cushion scale, a pest that threatened to wipe out the state's citrus crop. Since then, the pest has generally remained innocuous, making occasional comebacks only when insecticides have been overused. This spectacular success triggered biological-control programs in many parts of the world, and so far at least 327 introduced natural enemies have successfully controlled pests.

The technique's payoffs in crops saved and chemical costs foregone are virtually limitless. For example, introducing *Chrysolina* beetles to control a California range weed toxic to cattle cost about $750,000 in the 1940s, and savings have reached more than $100 million. Also, because biologists choose their target pests and beneficial species very carefully, the success rate for inoculative release is remarkably high—55 to 75 percent of the introduction programs have been effective. And because of the extreme care scientists have used in screening natural enemies before release, the environmental cost of this approach has been almost zero.

Biological agents need not become permanent parts of the ecosystem to be effective. "Inundative release" entails periodically blanketing an area with beneficial species of insects, microbes, and other natural enemies—living pesticides—to bring pest numbers down to tolerable levels. For instance, U.S. soybean farmers effectively and economically control the Mexican bean beetle by annually releasing a parasitic wasp that the U.S. Department of Agriculture (USDA) supplies at cost. These biological

PHOTOS: USDA AGRICULTURAL RESEARCH SERVICE



Inset: The USDA is also conducting field trials of this parasitic mite, *Coccipolipus epilachna*, which feeds on the Mexican bean beetle. The mite should prove important to bean farmers, as it is designed to become a permanent part of the ecosystem.

agents later succumb to natural causes, such as seasonal climate change.

Like chemical pest control, inundative release involves continual expenses for production, storage, transportation, and application. This means that unlike inoculative release, which requires public funding to support a one-time, regional effort, inundative release is a likely target for commercialization. In many parts of the world, private firms sell pest-controlling microbes—most notably *Bacillus thuringiensis* (BT). BT enjoys widespread popularity as a means of controlling various types of caterpillars, and a new variety of BT has proven very effective against mosquitoes and blackflies. These inundative biocontrols are sometimes more expensive than chemicals, but the approach is often cost-effective for high-value crops such as tree fruit and greenhouse crops. The approach also becomes attractive when the risks of human exposure to chemicals are unacceptable.

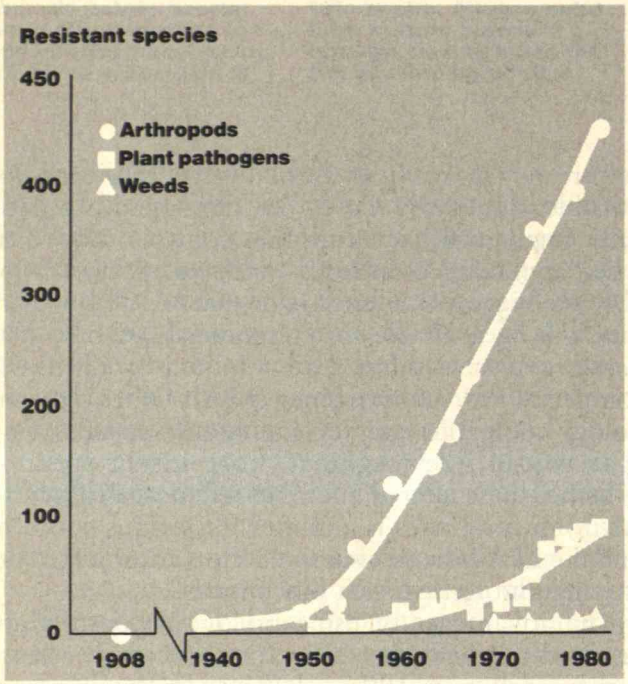
New techniques in genetic engineering and tissue culture may make wider use of this type of biocontrol possible. Monsanto Corp. has developed a genetically engineered bacterium that controls rootworm when applied to corn seeds—tapping what is probably the biggest U.S. insecticide market. The bacterium will be available for commercial use only if it passes extensive safety tests required by the Environmental Protection Agency (EPA). Other biotechnology companies are developing new strains of BT that would work against more insect species. Whether these altered microbes will pose health and environmental risks is a matter for serious concern, and the EPA is beginning to develop criteria for registering and testing such biocontrols.

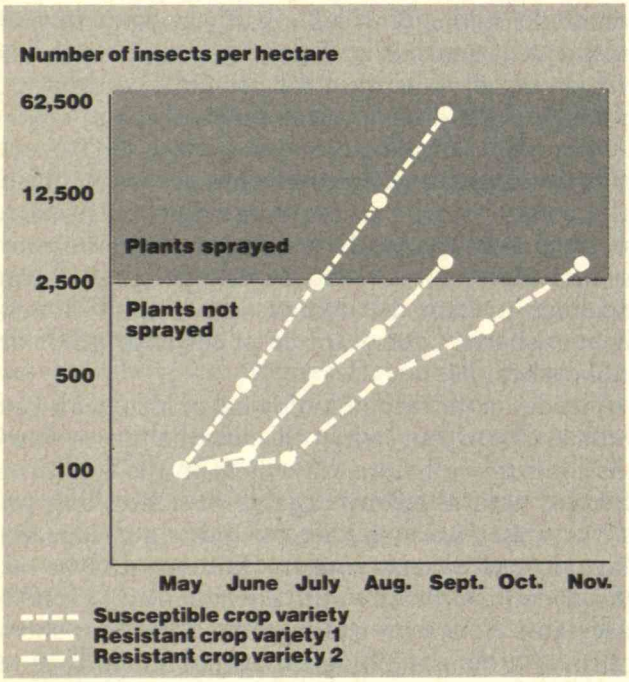
The advantages of using biological controls are great: the benefit-cost ratio for inoculative release can be well over 100 to 1, according to a report prepared for the World Bank. By comparison, an independent analysis at Cornell University puts the average benefit-cost ratio for chemical control at 3 or 4 to 1, depending on environmental costs. Yet the full potential of biological controls to reduce chemical costs, increase yields, and enhance environmental quality is still unrealized. This unfulfilled potential seems particularly unfortunate in the poorest countries, many of which spend precious foreign exchange to gain the dubious short-term gains of chemical-based control (often at the expense of the public's health).

A leader in the field of biological pest control, Paul DeBach of the University of California, has written, "As long as we ignore, anywhere in the world, an effective natural enemy capable of controlling one of our major pests, we are postponing cheap, reliable, and permanent control." We may also be sacrificing public health and environmental quality every time we opt for a potentially hazardous chemical over a benign biological agent. But further research is necessary: how much we can take advantage of pests' natural enemies ultimately depends on how fully we understand their ecology and behavior.

Cheap and Effective: Host Resistance

Over their long evolutionary history, plants have developed host resistance: ways to ward off almost every insect and pathogen that has attacked them, as well as means to compete with other plants for water and nutrients. Whether through trial and error





Top: The number of resistant species of arthropods (insects, mites, and ticks) has risen dramatically with the burgeoning use of pesticides since World War II. The number of resistant weeds and plant pathogens, which include fungi and bacteria, are also on the rise. (Source: Georghiou and Mellon)

Bottom: By growing pest-resistant plants, farmers can reduce the number of insects and slow down their life cycles. Thus, less pesticide can be applied, and its use delayed. This chart shows the effects of two varieties of resistant plants on a hypothetical pest population. (Source: Adkisson and Dyck)

or with the aid of modern breeding techniques, farmers have always selected crop varieties with superior host resistance. Growing resistant crops is often the easiest, cheapest, and most effective way to control insects and diseases. Indeed, for some pests, especially plant viruses, there are no known alternatives.

As much as 75 percent of U.S. cropland is planted with disease-resistant strains, creating a net benefit exceeding a billon dollars. In Asia, resistance bred into rice varieties helps account for farmers' dramatic productivity gains over the last two decades.

Resistance allows fewer troublesome insects and pathogens to survive. It also slows down pest development so that populations do not peak during the growing season and farmers can delay pesticide use, conserving natural enemies. In addition, breeding can create crops whose planting, maturation, and harvest times do not coincide with pests' natural cycles. For example, growers' use of short-season cotton has done as much as any other control method to keep insects in check.

According to the U.S. Council for Environmental Quality, the benefit-cost ratio for efforts to develop host resistance is about 300 to 1, not including reduced pesticide costs. But research on host resistance must take a new form, since farmers are devoting more and more land to major crops. These crops are often of one genetic type, and global agriculture is therefore becoming more vulnerable to new strains of pests. For instance, in 1970 an epidemic of leaf blight struck the Corn Belt because large areas were planted with the same genetic type. Once the pathogen evolved a way to overcome the type's resistance, the entire "genetic lawn" lay open to infection. Losses were crippling.

Farmers can avoid such disasters by planting mixtures of similar genetic types that differ mainly in their resistance characteristics. Such "multiline" mixtures have halved the disease rate from rust fungi in oats. If host resistance is to remain a viable strategy, plant breeders and pest-management specialists must begin to consider not only how resistant plant types are but also how quickly pests can change to overcome plants' defenses. Too often, the tendency has been to try to stay just one step ahead of pests in this evolutionary race.

However, research on plant breeding may well be narrowing rather than broadening in scope. Progress in developing resistance has usually occurred in university and government laboratories, where scien-

DIAGRAMS: OMNIGRAPHICS

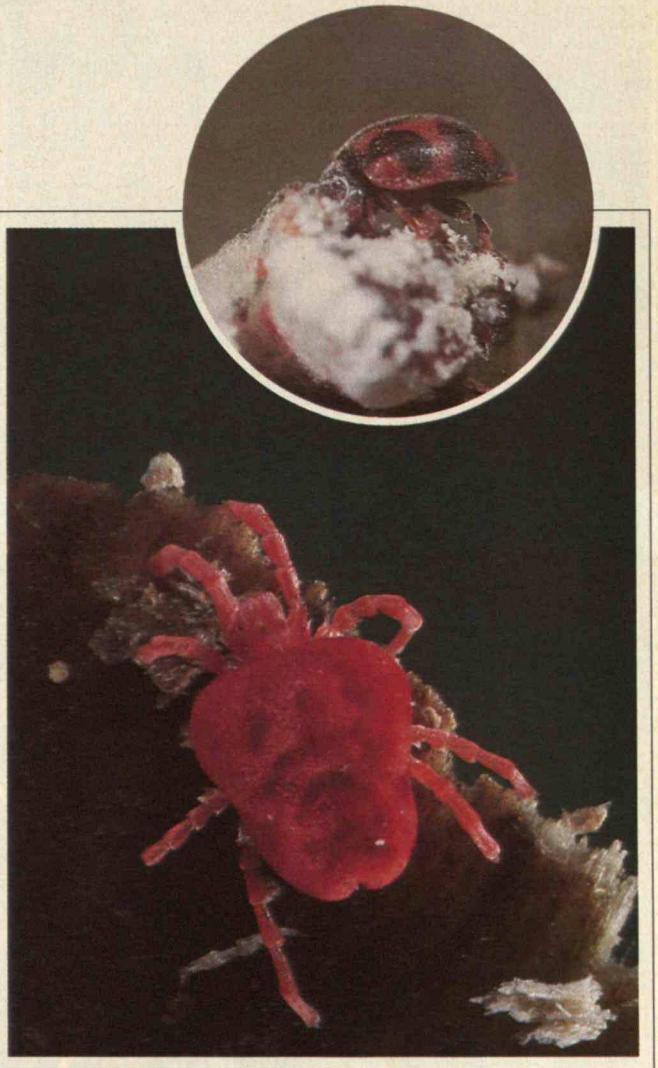
tists have been eager to publish their results so that all could benefit. Yet the USDA is funding less academic and government research, and breeding is becoming more commercialized. Competition will undoubtedly make plant-breeding companies reluctant to publish their results. Because of patenting, genes incorporated into one plant variety may be unavailable to breeders trying to improve resistance in another variety. Efforts to develop multilines and special resistant plants may lose out to work on plant characteristics that many farmers demand, such as improved response to fertilizers and greater ease in mechanical harvesting. Short-term goals may take precedence over long-term progress.

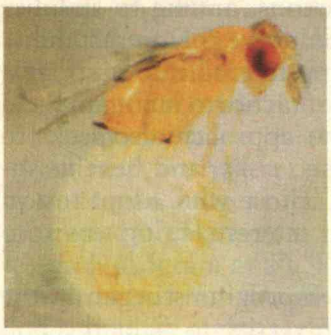
The only way to avoid these dead ends is for the USDA and universities to maintain a vigorous public plant-breeding program. It is especially important that public funds meet the needs of growers of fruits, vegetables, and other smaller-market commodities that may not attract enough private research capital. Commercial breeders may bring what is already in demand to the market quickly. But without public support for exploring what is not yet known, the private sector's apparent efficiency could be short-lived and our options for protecting crops and animals severely limited.

Putting the Pieces Together

The full potential of biological controls and plant resistance can be tapped only through a carefully coordinated pest-management program. Conversely, without such a program, biological controls could well fail. Improper or untimely use of pesticides could destroy biological agents. A resistant crop variety could decimate pest populations, starving predators and parasites important to natural control. Microbial pesticides may not work well unless carefully timed for maximum effect. In short, each technique's special characteristics deserve careful examination because of their potential effects on other elements of the pest-control program.

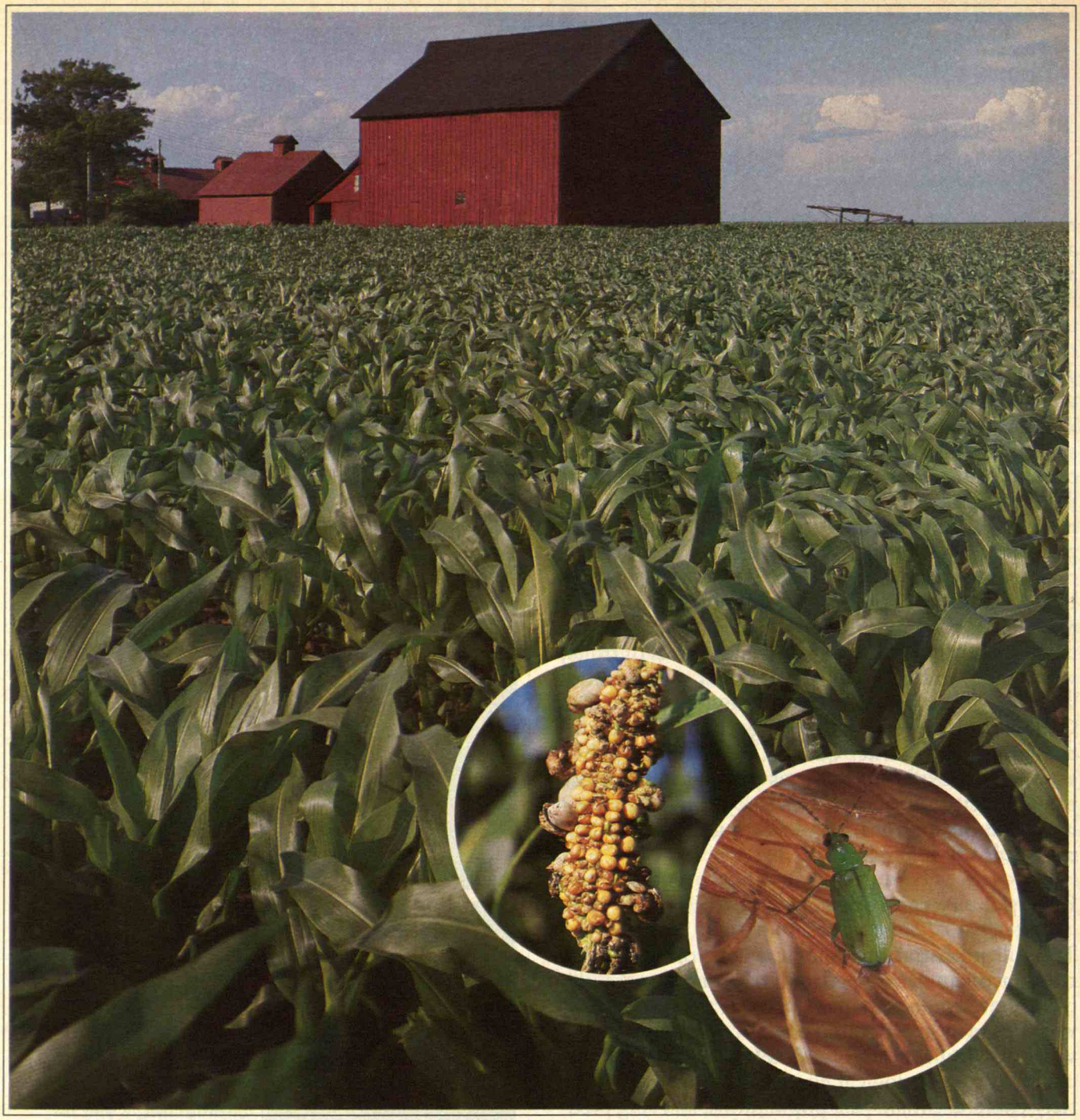
In the late 1960s and the 1970s, mounting evidence of the environmental hazards, health risks, and costs associated with indiscriminate pesticide use sparked interest in integrated pest management (IPM), just such a systematic, long-term strategy. Unlike conventional approaches to pest control, IPM is based on a sound understanding of the crop, its pests and their natural enemies, competitors, and alter-





Top: California introduced the vedalia lady beetle in 1888 to feed on the cottony cushion scale, which threatened to devastate the state's citrus crop. The beetle has controlled the pest ever since. Above: In its adult stage, this velvet mite feeds on harmful mites and insects. Left: Apple growers carefully select and time their use of pesticides to conserve this predatory mite, here feeding on a plant-eating mite. Bottom: Cotton growers in the United States, China, and Peru regularly release this tiny parasitic wasp, *Trichogramma*, to prey on the eggs of cotton pests.

PHOTOS: RUNK/SCHOENBERGER FROM GRANT HEILMAN; BRIAN CROFT; USDA AGRICULTURAL RESEARCH SERVICE



native hosts. IPM emphasizes "systems design" rather than knee-jerk reactions, aiming to stabilize pest-control systems and improve the predictability of control. Instead of trying to eradicate pests, IPM practitioners use a variety of tactics to maintain them at harmless levels. The IPM approach also seeks to balance the numerous costs, risks, and benefits involved in managing pests. Those who adopt IPM in their own best economic interests bring environmental benefits to all.

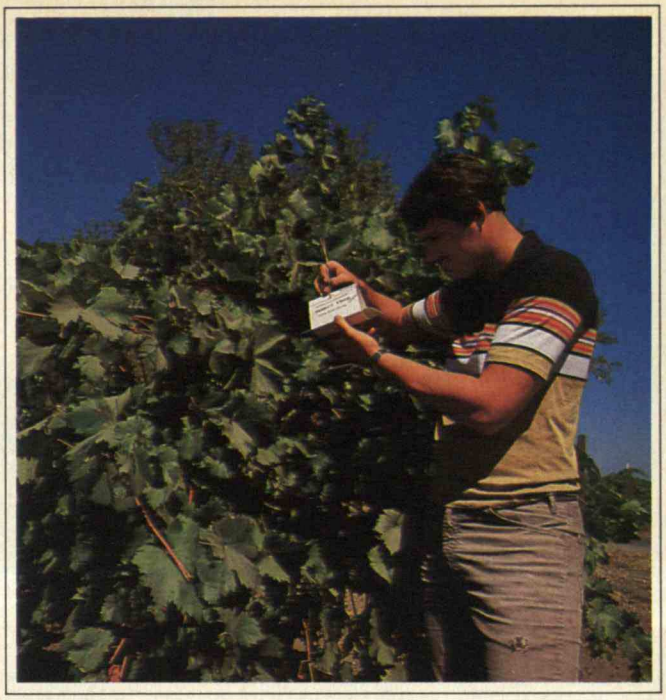
One of the first U.S. IPM programs began in the 1960s at Texas A&M University to fight the boll weevil and the pink bollworm, key pests of the south-central Texas cotton crop. Excessive spraying of insecticide had so disrupted natural controls as to make serious pests of another species of bollworm and the tobacco budworm—both previously innocuous. Although more chemicals temporarily kept these new pests at bay, the tobacco budworm eventually developed such high resistance that farmers faced ruin.

The IPM program has provided a more effective system for managing pests. The main lines of defense include the use of short-season cotton, which helps control the boll weevil, and the elimination of second and third cuttings, which ends the growing season

PHOTOS: LARRY LEFEVER, BARRY RUNK, FROM GRANT HEILMAN

Left: Illinois farmers monitor pest levels, rotate crops, and use pesticides carefully in a coordinated effort to control corn rootworm, here shown as an adult.

Right: Field scouts, who keep track of crop health and the population levels of both harmful and beneficial insects, are essential to such programs.



before the pink bollworm population can build up. Farmers also coordinate irrigation and planting times and plow under crop remnants to deny insects food and shelter at critical times. "Scouts"—working either for state extension services or as private consultants—monitor the population levels of pests and their natural enemies so that growers apply insecticides only when absolutely necessary.

These efforts have yielded dramatic results. In two counties where harvested cotton acreage had dropped from about 105,000 in 1970 to about 50,000 five years later, harvested acres increased to 236,500 by 1980. Farmers netted benefits estimated at $29 million from higher yields and lower production costs.

Illinois has also developed an IPM program to control corn rootworm. The EPA banned the principal insecticides heptachlor and chlordane in the 1970s, when unacceptable environmental and health risks cropped up. But the rootworm had been growing resistant to these chemicals for years anyway. Today farmers monitor pests, rotate crops, and selectively apply other insecticides. In fields where August rootworm counts are high, farmers plant soybeans or other rootworm-resistant crops the next year. Where fields are left in corn, farmers apply a soil insecticide only if each plant averages more than one rootworm. As a result, pesticide use has decreased, and insects are not becoming resistant. Also, the soybeans are conserving soil nitrogen, and the crop rotation is helping keep some weeds at bay. Even farmers who do not rotate their crops derive some benefit from the area's overall decline in rootworms.

Chemical pesticides are still the main means of control for apple growers, since pests attack the fruit itself and farmers hoping to sell in the fresh-fruit market can tolerate almost no damage. Yet even here long-term management strategies have reduced dependence on routine spraying. For example, Michigan has pioneered the use of an extensive system of agricultural weather stations, computer terminals, scouting services, mathematical models, and telecommunications to advise apple growers of prevailing pest conditions. These techniques help determine when insect eggs hatch and when adult males emerge from dormancy, so that farmers can carefully time their doses of insecticide.

The principles of IPM work equally well for managing insects, plant diseases, and weeds in forests, rangeland, pastures, suburban yards, and urban parks. The tenets are also effective against pests that attack livestock and people. The key is knowing as much about a pest and its environment as possible, and using this knowledge to determine when to intervene in the pest's life cycle.

Building an IPM Support System

IPM got its initial push in the United States from the federal government. The EPA, USDA, and National Science Foundation jointly funded a 17-university pest-management research effort in the early 1970s. This program, the Huffaker Project, laid the groundwork for using "systems science"—the basis of IPM—to solving pest problems. The Huffaker Project's successor, the 16-university Consortium for Integrated Pest Management, has made impressive gains in developing IPM programs for alfalfa, apples, cotton, and soybeans. Spurred in part by these results, the USDA began an extension program, now national in scope, to show farmers the benefits of IPM. The result is that a new industry of private IPM consultants has sprung up: scientist-entrepreneurs who provide monitoring and advisory services to growers of cotton, corn, fruits, and many other crops. Meanwhile, the USDA has been putting together an interdisciplinary research program to develop regional projects for IPM.

However, IPM has fallen on hard times since 1981. Along with many other programs, IPM has suffered from Reagan budget cuts. The EPA, the initial funder of ground-breaking IPM research, now has no IPM research program at all. The USDA's extension program has had to fight off yearly attempts to close it down, and the regional research projects in IPM have barely begun despite years of planning. A promising

PHOTO: KARL KUMMELS, FROM SHOSTAL ASSOCIATES

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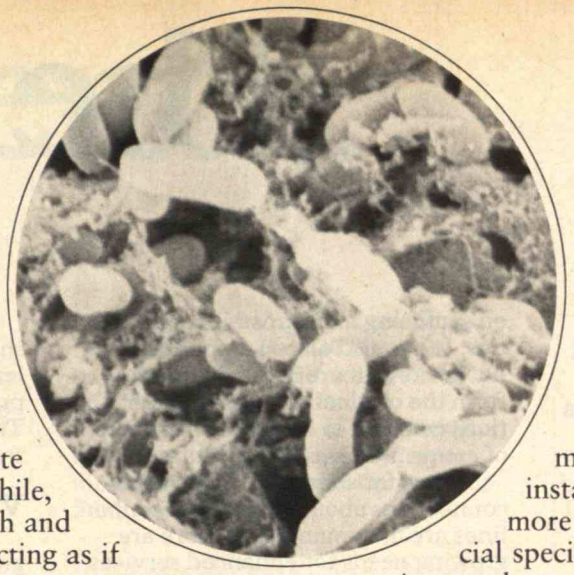


Several firms are developing genetically engineered strains of BT (*Bacillus thuringiensis*), a microbe commonly used to control caterpillars and other pests.

initiative of the Carter administration—a plan to make federal agencies adopt IPM whenever they use pesticides—died almost as soon as the White House changed hands. Meanwhile, at the state level, many research and extension administrators are acting as if IPM were a thing of the past.

Some of these setbacks are more than political in origin. Since the problems of an entire ecosystem are difficult to tackle and easy to avoid, IPM has lost out to a rebirth of the magic bullet philosophy. An appealing new generation of pesticides—the synthetic pyrethroids—has come along in the last decade. Many ecological concerns voiced in the 1960s and 1970s have faded in the rush to join the coming biotechnology revolution, which offers the prospect of yet another round of "breakthroughs" in pesticide development and plant breeding. These changes have helped spur today's private-product approach in agricultural research policy.

The attraction of relying on individual technologies, especially those developed by private firms, is obvious. Manufacturers provide an army of advisors—salespeople and technical-support staff—to farmers at no apparent cost to the taxpayer. In contrast, IPM requires an extensive, often publicly supported, infrastructure. Moreover, there are no economies of scale in providing IPM advisory services and field-level monitoring, unlike in manufacturing. Extension agents who teach sound ecological principles to the next generation of farmers and pest-management consultants can promise only long-term rewards. Proponents of the biotechnology boom, on the other hand, have been promising lucrative near-term payoffs.

But leaving pest management to market forces invites a new round of "surprises" from pest resistance and resurgence, and from outbreaks of secondary pests. Rather than waiting to be surprised, policymakers should begin programs to ensure that the most-needed technologies are developed and used.

When a company or university develops a new technology, federal and state agencies should carefully weigh its potential for disrupting present pest management. For instance, the EPA now pays little attention to the possible effects of pesticides on beneficial species. The agency should require chemical companies to test for these effects before it approves pesticides for general use.

Where market forces alone cannot foster sound pest-management technologies, government action is essential. For instance, the USDA should fund more programs to introduce beneficial species. Methods of predicting how insects become resistant to pesticides are crude at best, as are means for anticipating the durability of host resistance. Again, federally supported research is necessary. In addition to funding programs to develop new varieties of pest-resistant crops, the USDA should set standards for pest resistance that all breeders must meet. The USDA could also provide more support for research on using biotechnology to improve pest control.

How should the government finance this new IPM infrastructure? A public fund based on a nominal sales tax on pesticides—two cents per pound, for instance—would raise about $20 million a year, enough to defray most of the costs. By comparison, the entire EPA research budget for IPM from 1970 to 1980 was only $19 million. Commodity associations and farmer cooperatives could cover some of the rest, funding crop-specific research and monitoring activities. Of course, in today's political climate, Congress is unlikely to consider any new tax, however, modest, to fund government programs. But a pesticide tax for IPM is just the sort of "pay-as-you-go" system—in which the beneficiaries are the principle source of funds—that makes sense.

Just as the airline industry depends on publicly supported weather monitoring and forecasting, air-traffic control, and safety research and regulation, so too do pest control and its associated industries require the research, monitoring, and advisory services that only the public sector can provide. And just as human health-care systems require effective national management, so do plant-health systems. Without such support and management, progress in developing sustainable, ecologically sound pest control will be sporadic at best.

MICHAEL J. DOVER, an ecologist and consultant based in New Hampshire, is the author of A Better Mousetrap: Improved Pest Management for Agriculture, *a report recently published by the nonprofit World Resources Institute. This article is based on that report. Dr. Dover has been a member of the Integrated Pest Management Unit in the EPA's Office of Pesticide Programs, and has worked in IPM research and agricultural extension at Michigan State University.*

PHOTO: MONSANTO

The uses

Summary:

Even the smoothest voice is discontinuous, especially in conversation. Data communications has bursts of message and periods of silence, too. Even TV has some "bursty" traits. GTE scientists are isolating silences and inserting other messages into them. This permits voice and data to coexist on the same channel at the same apparent time. The development stems from parallel research in microelectronics, silence detection, speech, voice compression and signal processing.

Without basic change, or vast growth, telephone networks will be unable to cope with the anticipated traffic of the 1990's. The proliferation of personal computers and data terminals has already placed a strain on switching and transmission facilities. It has also placed demands on networks that are much different from the original voice-communications concept, in which average time of connection was three minutes.

Today, far shorter and far longer connections abound, more subscriber lines are in demand, and there are growing needs for enhanced services and faster switching.

Out of research dating from 1979, GTE has developed a switching system that promises not only to triple present transmission capacity but also to process calls 20 times faster. The system is called Burst Switching.

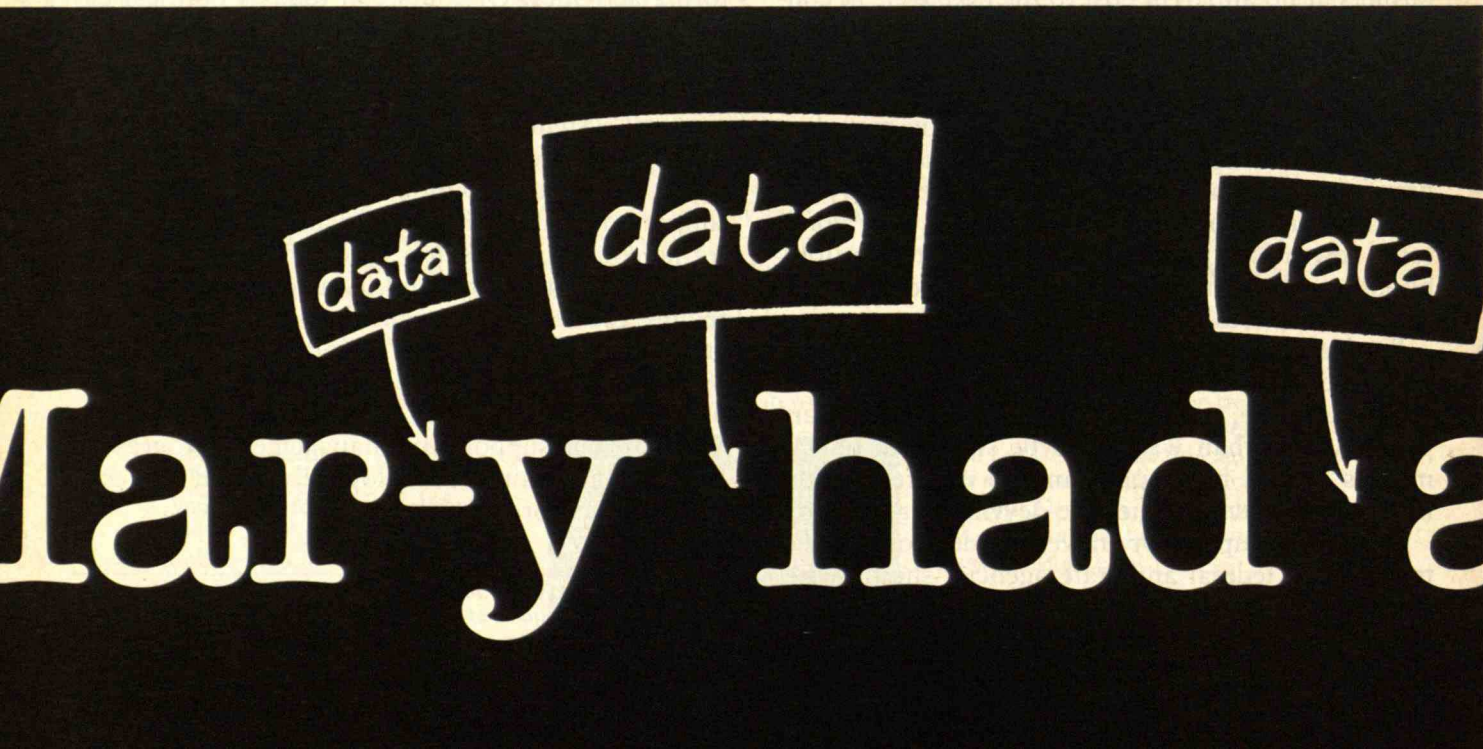
The nature of speech.

Our world is full of holes. Matter is mostly empty space. Conversation is mostly silence. But, even though speech is 2/3 silence interspersed with bursts of sound from 0.1 to 1.5 seconds long, if that speech goes over a telephone line, the line is locked up for the duration.

But, with Burst Switching, we can shoehorn other messages into the silences, automatically easing the pressure on transmission facilities. Theoretically, in fact, we triple transmission capacity.

VHSIC.

Through Very High-Speed Integrated Circuits (in which we are currently researching devices with submicron feature size), we are able to make and break telephone connections at increasingly high speeds. Voice lines need be dedicated only for the very brief duration of voice bursts. At other times, channels are available for other voice messages, or for data streams which are also "bursty" in nature. In addition, video, because of its built-in redundancy, can be considered to have bursts, too.



# of silence.

Message compression.

The capacity needed to transmit speech can be made even smaller if the information that must be sent to make it recognizable can be minimized. Our scientists have reduced the 64 kb/s signals to 16 kb/s while retaining high quality.

Thus, transmission-capacity requirement is reduced by a factor of four.

We are working, as well, on techniques for compressing video signals from 90 Mb/s to 64 kb/s. This will have special relevance for such activities as video conferencing.

So transmission capability grows and switching becomes faster—and we can now envision future telephone systems able to carry billions of simultaneous calls.

The box at the right lists some of the pertinent papers GTE people have published on Burst Switching and related subjects. For any of these, you are invited to write GTE Marketing Services Center, Department TPIIB, 70 Empire Drive, West Seneca, NY 14224.

Burst Switching experimental model.

Pertinent Papers.

Burst Switching—An Introduction, IEEE Communications Magazine, November 1983.

New Switching Concept Integrates Voice and Data Bursts, PROFILE, September 1983.

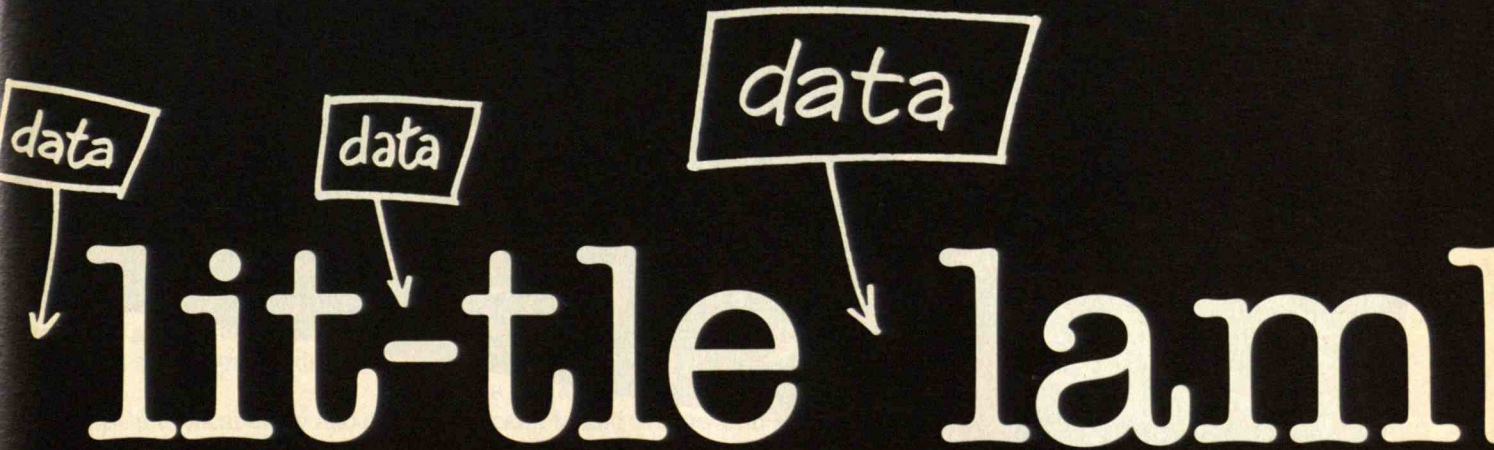
A PCM Frame Switching Concept Leading to Burst Switching Network Architecture, IEEE Communications Magazine, September 1983.

Application of the Burst Switching Technology to the Defense Communications System, Proceedings 1983 IEEE Military Communications Conference, MILCOM '83, Washington, D.C.

Performance Evaluation of a Distributed Burst-Switched Communications System, Proceedings Second Annual Phoenix Conference on Computers and Communications, March 1983.

A Complementary Speech Detection Algorithm, Proceedings of GLOBECOM '83, November 1983.

GTE



In Burst Switching, the roughly 65% silence in speech can be filled with data streams and other messages, effectively tripling transmission capacity.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PARE?
PEAR?

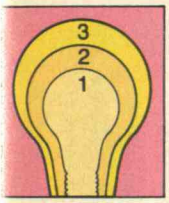
Would you like to know how computers can tell the difference between a pair in a poker game and a pear on a plate?

How they can understand a variety of speakers with a diverse variety of accents—and reply in pear-shaped tones, using normally connected speech?

Then read on to learn more about computers that recognize words, comprehend meaning from context, even synthesize human speech from a mere shadow of itself.

It's All In The Algorithms

Utilizing three levels of speech-processing algorithms, AT&T is giving the computer a more 'robust' understanding—the capacity to comprehend connected speech from different speakers.



Three levels to understanding

Acoustic pattern matching (1) identifies the spoken words.

Grammatical processing (2) figures out how the words are put together.

And semantic processing (3) extracts meaning from the context. With each successive step, the computer moves closer to accurate understanding.

Acoustic pattern matching determines how much latitude the waveform (pronunciation) of a word can have before it becomes unintelligible to the computer.

By isolating the specific characteristics the waveform of a word contains—independent of the accent of a speaker—we increase the probability that it will be correctly matched to a pattern stored in a computer's memory. But, correct recognition of words is only the beginning of computer understanding.

Computer Grammar 101

Grammatical processing further increases the probability of recognizing words. It analyzes them within the constraints imposed by language—the allowable sequences of syllables in a word or words in a sentence.

For a specific vocabulary and situation, it is possible to define every sequence the computer can recognize. Based on probabilities assigned to each word it recognizes—and where that word falls—the computer determines which of its possible sequences is the most likely. This process gains two advantages: It allows words that might not otherwise be recognized to be correctly accepted; and it speeds up processing time by using sequence position to limit the number of words it looks at for a pattern match.

A Meaningful Relationship

Semantic processing is the point where the computer crosses the line between recognition and understanding—the point where words are given meaning within a specific context. This endows a system with one of its most human qualities: knowing when a request isn't understood, and asking for appropriate clarification.

Talk Isn't Cheap

Making a computer listen intelligently is one thing; making it respond intelligibly, however, is another.

Enabling a computer to talk, reproducing the subtleties of human speech, has required large amounts of memory—a high cost item. Therefore, an 85 percent reduction in the amount of information needed to store and generate high-quality speech can mean significant cost reductions.

That's just what a new AT&T speech synthesis technique, called multi-pulse linear predictive coding (MP-LPC), provides. It reduces the 64 thousand bits per second previously needed to 96 hundred.

Speech signals mimic the human vocal tract—they have redundancies built in. MP-LPC codes speech to remove these redundancies, then tells the computer how to reconstitute the original speech from the mini-version in its memory. This coding eliminates unnecessary bits from being stored and transmitted.

Getting Down To Business

At AT&T, our goal is to make computers listen and understand as fast as people speak—and speak to and understand as many people as possible. Speech-processing algorithms, developed by AT&T Bell Laboratories, have moved us several steps closer to that ideal.

For example, most speech recognition systems make the speaker pause between words. But AT&T, using advanced recognition algorithms, has developed a Stock Quotation System, now in field trial, that allows callers to enter and retrieve current market information in natural, normally-connected speech. Users simply speak the number codes for any of over 6,000 stocks, and the service provides current quotes—delivered in computer-generated speech.

Numbers are nice, but make for limited conversation. Closer to our goal of a conversational computer is the Flight Information System. It uses the Official Airline Guide as its data base. In its limited environment, this laboratory system converses with the user in natural speech in response to normal flight information queries.

One Of Our First Callings

AT&T has been deeply involved in speech technology since the genesis of the telephone. From the beginning, our goal was to make mechanical communications fast, foolproof and economical.

Today, with the advent of the computer, we're moving toward the ultimate ideal: creating machines that serve our needs and save our energy in the most natural manner—by voice command.

AT&T

The right choice.

PHOTO: EASTFOTO

The Limits of Soviet Technology

The all-consuming Soviet military sector stands against a backdrop of crude civilian technologies. The country builds apparently modern systems such as rockets with outmoded engineering and cannot easily incorporate Western advances.

Parade celebrating the Russian Revolution.

In the late eighteenth century, Empress Catherine II of Russia appointed Grigory Aleksandrovich Potemkin, a statesman whose brilliance was exceeded only by his ambition, as governor general of the Ukraine. He conceived a plan to colonize the vast Ukranian steppes, and his progress reports were so glowing that in 1787 Catherine decided to see the miracle for herself. Trapped by his own exaggerations, Potemkin sought a way to hide the failure of his plan by constructing impressive fake villages along Catherine's route. The trick worked.

The Soviet Union today accomplishes some impressive technical feats. The Soviets have some counterpart for nearly every U.S. technology. They have built supercomputers and fabricated microprocessors. Their weapons systems, as described in the Pentagon's annual *Soviet Military Power,* seem awesome.

However, the Soviets' civilian technological base is weak. Compare, for example, their scant use of information technology with its pervasive role in the United States. Even in small American towns, supermarkets have electronic cash registers that use laser scanners to read prices from universal-product-code labels. In the Soviet Union many food stores do not even have mechanical cash registers. Clerks use the abacus instead. Most large U.S. manufacturing plants installed mainframe computers by the mid-sixties, but 20 years later only a third of com-

BY LOUIS LAVOIE

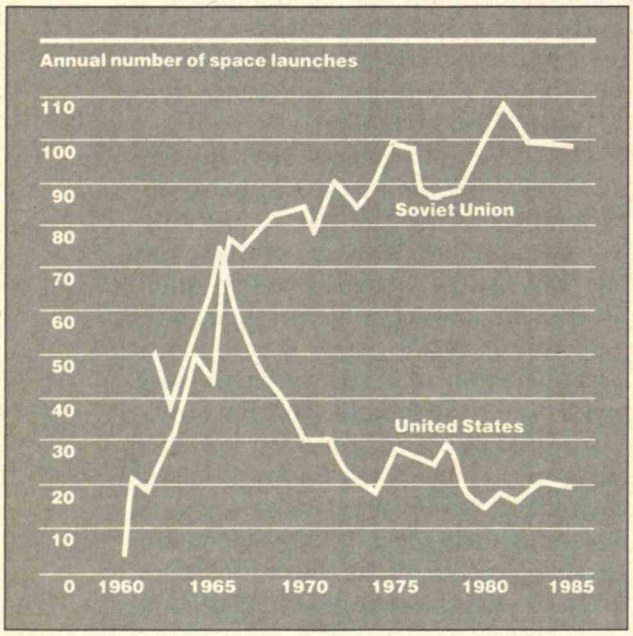
As a Soviet scientist now living in the United States says, "We solve problems by brute force."

parable Soviet plants have such computers, according to William K. McHenry of Georgetown University's School of Business Administration.

Why do Soviet achievements in selected areas stand out as apparent miracles against the backdrop of a relatively backward civilian sector? Is Soviet technology built of Potemkin villages?

Soviet Technological Feats

The Soviet technical establishment is very large, now numbering substantially over 1 million scientists and engineers. A force of this magnitude can attack technical problems with considerable intensity and assurance of success. The Soviet historian R. Medvedev says Americans conclude "that since Russia can't run a hotel, it can't build a rocket either. They don't realize that we put everything into rocketry."



Comparing the number of U.S. and Soviet space launches: This chart comes from the Pentagon's annual *Soviet Military Power.* However, the United States launches fewer satellites for a reason: its spacecraft last longer. By mid-1983 only 5 percent of all Soviet spacecraft were still functioning, while more than 18 percent of all American satellites were working.

The Soviet space program is perhaps the country's most impressive technological accomplishment. It has launched over twice as many satellites as the United States. *Sputnik I* was the first successful artificial satellite. Shortly thereafter the Soviets orbited and recovered a live dog in *Sputnik II* before the United States had made one successful orbital launch. The Soviet *Luna II* was the first spacecraft to go to the moon, Yuri Gagarin was the first person in space, and the Salyut series of space stations has given Soviet cosmonauts several records for duration in orbit.

As for rockets, the Soviets have always had big boosters. They put the 1,120-pound *Sputnik II* into orbit before the United States launched the 31-pound *Explorer I,* and their SS-18 intercontinental ballistic missile (ICBM) is the largest deployed anywhere.

The Soviets have had similar apparent success with their aircraft. In 1973 Robert C. Seamans, then U.S. secretary of the air force, described the MIG-25 as "probably the best interceptor in production in the world today." Modified Soviet MIG-25 Foxbats hold an official world speed record at 1,852 mph and the absolute altitude record for jet aircraft at 123,524 feet. The world's largest and fastest commercial supersonic transport, the TU-144, is a product of Soviet technology.

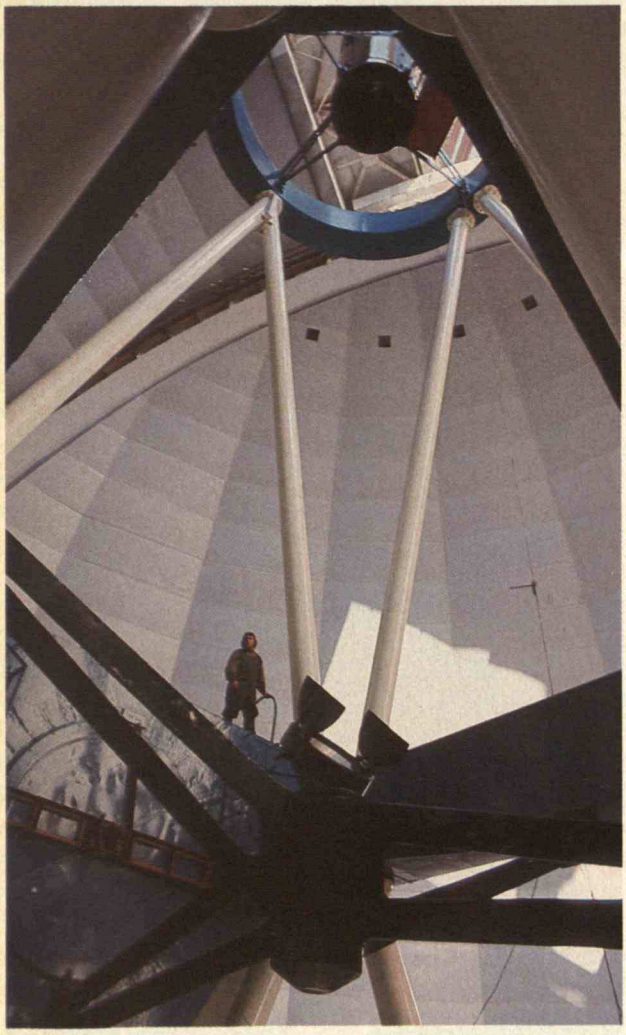
The Soviets have always tended to the theoretical, so it is no surprise that they have shown some scientific strength. Figures such as Pyotr Kapitsa, Nikolai Basov, and Lev Landau, whose contributions to basic physics have earned each a Nobel Prize, represent the best of Soviet science.

The technology associated with some Soviet physics suggests an advanced capability. For example, Vladimir Veksler discovered the "phase-stability" principle used to accelerate subatomic particles to very high energies in the synchrocyclotron. The proton synchrotron at Serpukov has been operating with an energy of 76 billion electron volts; only a handful of comparable machines exist worldwide. The Soviets are constructing a particle accelerator at Serpukov that will be the world's largest when completed in the 1990s.

The Soviets discovered the Tokamak plasma-confinement principle, one of the most successful ways of magnetically confining plasmas at millions of degrees in fusion reactors. The world's largest single-

DIAGRAM: OMNIGRAPHICS

Operating since 1976, the six-meter Bolshoi telescope in Zelenchukskaya remains the world's largest. However, it has yet to produce any significant data, and probably never will because of the poor quality of its mirror. The inferior optics and somewhat extravagant visitors' gallery suggest that the entire facility was conceived primarily as a public-relations effort.



mirror telescope, the six-meter Bolshoi Telescope at the Special Astrophysical Observatory in Zelenchukskaya, has been operating since 1976.

Soviet submarines are noted for their unsurpassed speed and diving ability. Alpha-class subs are alleged to be capable of traveling faster than 49 knots submerged, with a maximum diving depth of 1,350 meters. Though exact figures are classified, U.S. subs are known to be capable of more than 30 knots and a diving depth of 450 meters. According to defense sources, the Alpha achieves its performance because its hull is built of strong, lightweight titanium. Although the Soviets' first such submarine was launched in 1970, the United States has not yet shown the ability to make an equivalent sub.

Technological Potemkin Villages?

Exposing the limitations of Soviet technology carries the implicit assumption that it *should* meet Western standards, and that is unreasonable. Soviet technology suits the country's requirements and world views. Relatively crude Soviet technologies often do the jobs they are designed to do, just as our more sophisticated technologies often do the jobs we require. In this way Soviet technology is a formidable resource. My aim is not to dismiss it but to describe its apparent contradictions and to draw the implications for East-West relations.

Despite the Soviet Union's many achievements, it is difficult to find any one of them that is not less than it seems. Given the extent of the Soviet science and technology establishment, it has produced remarkably little of substance. Consider the basic sciences. Since the first Nobel Prize was awarded 84 years ago, the United States has won 132 while the Soviet Union has won 8. Even more telling is the fact that while the number of U.S. winners per decade is increasing, the number of Soviet winners per decade is decreasing. The United States has won 23 Nobel Prizes since the last Russian won in 1978. This suggests a profound weakness at the very foundation of the Soviets' science and technology establishment, one that is especially significant since their best talent tends to go into the basic sciences.

Much of the Western technical community feels that the Soviets are generally not very good in science and technology. Indeed, some influential sectors of Soviet society seem to agree. In 1982 Premier Yuri Andropov said that the Soviet technical establishment was so unproductive that he wanted a 25 percent staff reduction by 1985.

Part of this failure can be attributed to a political and economic system that discourages risk taking. The limited rewards for success hardly outweigh the penalties for failure. Although the Soviet system has moderated in recent years, failure has historically meant exile, imprisonment, and even death. Also, to foster productivity, an economy must be flexible in distributing resources to the most efficient enterprises. However, that flexibility just doesn't exist under the rigid five-year plans of the Soviet Union.

PHOTO: TASS FROM SOVFOTO

Soviets put the first dog in space, but the early Sputniks produced almost no scientific results. Soviet cosmonauts have set endurance records in space — growing homesick with nothing to do.

Part of the Soviet technical failure can also be attributed to a Catch-22. Almost every Soviet technical project has been seriously limited because it lacked good instrumentation, whether for monitoring civilian production or assessing scientific results. And there is little good instrumentation because of the limited ability of the Soviet industrial base to produce it.

The instrumentation problem probably helps account for the almost total lack of significant Soviet results in fusion and elementary particle physics, despite the existence of major Soviet facilities. Of the hundreds of elementary particles found in recent years, not one was discovered at a Soviet laboratory. The Bolshoi Telescope at Zelenchukskaya is virtually useless for advanced astronomical work. It has yet to produce any significant data, and probably never will since the inferior design and construction of its mirror and mirror support give it poor image quality. Moreover, the observatory is located in an area that has poor visibility but that is relatively accessible to the public. The inferior optics and somewhat extravagant visitors' gallery suggest that the entire facility was conceived primarily as a public-relations effort to capture the record for the world's largest mirror.

Just as space technology is the area of most significant Soviet accomplishment, so it is also most nearly an example of a technological Potemkin village. Even before the United States launched *Explorer I,* the Soviets managed to put 43 times its weight into orbit. However, the scientific results from the first Sputniks were almost nil. It was as if the spacecraft were empty. Among other things, the Soviets failed to detect one of Earth's most prominent features—the Van Allen radiation belts, discovered with just a few pounds of simple electronics in *Explorer I.*

The Soviets were the first to get to the moon, but except for observing and naming some large features on the backside, they have not produced a single scientific payoff from these spectacular efforts. The quality of some Soviet lunar petrology would embarrass an American graduate student.

Through the end of 1982 the Soviets had launched 2,069 payloads into space, whereas the United States had launched only 997—but for good reason. By mid-1983 only 5 percent of the Soviet craft were still functioning, while over 18 percent of the U.S. satellites were working. (This ratio is actually much worse for the Soviets than it appears, since they have made most of their launches relatively recently.) The reason for the short life of Soviet space vehicles isn't altogether known, but it probably relates to poor reliability, limited propulsion and control capabilities, and low-technology electronics and power sources.

The engines in Soviet space rockets are notable only for the large number clustered in a single ve-

PHOTOS: TASS FROM SOVFOTO

The first Soviet jet transports proved so unreliable that all remaining orders were canceled.

hicle—up to 20 in some cases. The Soviets have no operational engine with a thrust comparable to that of the U.S. *Saturn V* engine of almost 20 years ago.

These technical limitations carry over to the field of large military rockets. It has been 22 years since the United States fielded its last liquid-fueled ICBM—the *Titan IIc*, which is just now being withdrawn from service. Nevertheless, the Soviets continue to deploy their newest heavy ICBMs, the SS-18, SS-19, and SS-24, with liquid-fueled engines. Liquid fuels are much more difficult and dangerous to handle than solid fuels because they tend to be corrosive, explosive, volatile, and poisonous. The logistical problems of maintaining a force with over 600 liquid-fueled missiles must be staggering. Surely the Soviets would avoid such missiles if they knew how to make large, reliable solid-fuel rockets such as our MX and space shuttle booster.

The design of Soviet submarines also has glaring weaknesses, particularly in nuclear reactor technology. *Jane's Defence Weekly* reports numerous failures resulting either in the loss of subs or severe radiation exposure of crews. Soviet submarines are so unreliable that the country can keep only 11 to 17 percent at sea, while the United States keeps over 51 percent of its subs at sea. Even the Alpha subs with the titanium hulls have provoked skepticism. Analysts including the internationally known Norwegian submarine designer Kare Heggstad point out that with its stated hull displacement and engine power, the sub would have to defy the laws of physics to achieve its reported speed and diving depth.

When the Soviets first sold commercial jet transports, they had to take a loss and price them at about half what comparable U.S. jets would cost to attract wary customers. When a few Third World airlines bought these transports, they proved so unreliable that all remaining orders were canceled. The supersonic TU-144 has had such a long history of problems that it was recently withdrawn from service in the Soviet Union.

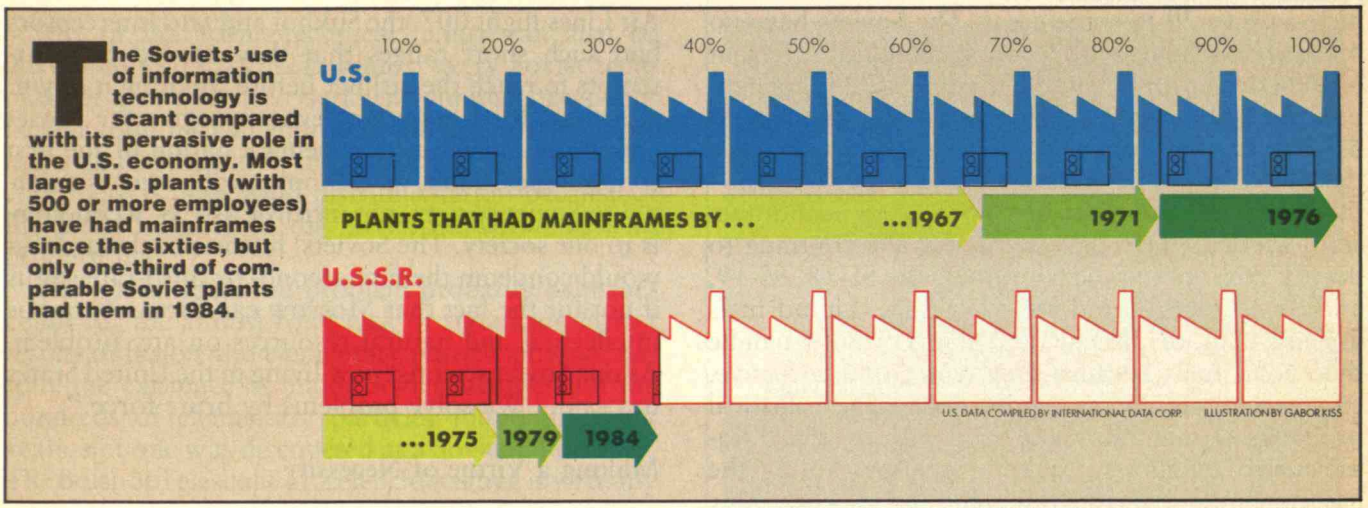
When a defecting pilot flew a MIG-25 Foxbat to Japan in 1976, Western technicians discovered that it was poorly made, with almost dangerously weak welds. It had a surprisingly short range, primitive vacuum-tube electronics, and the ability to fly only once at maximum performance before burning out its engines. In the recent infamous attack on Korean Air Lines flight 007, the Sukhoi and MIG interceptors had such short ranges that they needed three attempts to reach the airliner before shooting it down.

Although its many achievements give the Soviet Union the appearance of being a nation of the first technological rank, its technological power is external to Soviet society, not intrinsic as U.S. technology is to our society. The Soviets' historic backwardness would condemn them to second- or third-rate status if not for the fact that Moscow can focus enormous intellectual and natural resources on any problem. As one Soviet scientist now living in the United States has said, "We solve problems by brute force."

Making a Virtue of Necessity

Soviet technological development contrasts with that of the United States. While the United States tends to pursue revolutionary change, the Soviet Union tends to favor evolutionary progress; while this country often introduces entirely new technologies and systems, the Soviets make step-by-step improvements. Weapons systems provide an example. Soviet weapons designers have modified the T-54 tank of the fifties to the T-80 of the eighties by upgrading the main gun from 100 to 125 millimeters, redesigning the turret and gunsight, upgrading the engine, redesigning the hull and suspension, and including heavier armor. The MIG series of aircraft has also evolved through incremental changes in electronics, weapons, engines, and general airframe configuration.

One advantage of this approach is that designers can apply past experience to present programs. Manufacturers can produce new systems relatively easily and contain costs—two factors very important to the Soviets. They learn quickly from their mistakes, and their designs are pragmatic and straightforward. They rarely deploy multimission systems such as the U.S. F-4 Phantom, which can land on either a runway or an aircraft carrier and can be used for air combat or ground-troop support. The Soviets add nothing to a system that won't directly improve its performance in its mission. They often omit technologically complex features, even those that could yield great improvements. For example, they use a casting process to make titanium rotor-head components for helicopters, even though the more dif-



ficult forging process can produce stronger and more reliable parts.

When the Soviets avoid technological risks, opting instead for gradual development of relatively simple, producible systems, they are in part acknowledging their own weakness. They have made a virtue of necessity—a fact sometimes missed by Western defense analysts who fail to see the degraded overall performance of the simple, if not crude, systems.

Barriers to Technology Transfer

The Soviets attempt to compensate for their lag by importing foreign technologies, and this has precipitated the phobia about technology transfer that is sweeping the United States. What I would call "concept transfer" does occur: unable or unwilling to copy the details of a complex foreign system, the Soviets copy the concept and simplify it to the level of their own abilities. However, little actual transfer of technology occurs.

One reason is that while scientific knowledge is transferred largely through published research, technology transfer requires the exchange of a great deal of intuitive knowledge, often manual. Engineers know that reading articles about a new technology does little to help them actually reproduce it. The real benefit comes from hiring someone who already knows the technology or from being tutored by someone from a laboratory that is using it. Effective technology transfer requires the transfer of people, and that is not happening between the West and the Soviet Union.

Even when the Soviets do manage to import a technology, they may not benefit much from it because, just as science is not technology, technology is not manufacturing. By special effort, they may produce a few tens of thousands of relatively modern integrated circuits in laboratories, by either copying them from Western samples or developing them on their own. However, this does not make a meaningful semiconductor industry. The Soviets lag far behind the West in all technologies based on semiconductors, and this gap may well increase and create profound problems for them in the decades ahead. Even though the Soviets can produce a prototype of almost anything, no matter how much effort is required, that doesn't mean they can make nationally significant numbers of the item with acceptable quality. Westerners should not be fooled by modern-day Potemkin villages.

The field of rocket propellants and explosives provides another example of the barriers that stand between acquiring theoretical knowledge of a subject and applying it in products. The Soviets have traditionally contributed many scientific advances to this area, but they have not often been able to field advanced solid rocket fuels and explosive devices. Israelis who have faced their tank-gun ammunition from Syrian guns consider it inferior. The Soviets

DIAGRAM: FORTUNE MAGAZINE

If the Soviets try to rely on technology transfer, they will only delay their own engineering progress.

appear unable to produce small antitank mines that can be scattered, as these require sophisticated explosives technology. The Soviets not only lag in producing large, solid-propellant rockets, but they also seem to have difficulty making smaller rockets with effective propellants. Their Sagger antitank missile is notoriously slow, for example.

A recent study for the Defense Department by B-K Dynamics suggests the limited benefits the Soviets are likely to receive through technology transfer from the United States in the years to come. The report says that the Soviet bloc's military services may save $6.6 billion to $13.3 billion from 1985 to 1997 if they acquire our high technology in 79 different areas. This amounts to less than 0.3 percent of the bloc's military budget. The annual savings in each technological area come to only $7 to $14 million. While these numbers may not fully reflect political and military benefits, the Soviets' potential advantage from technology transfer does not appear to be great.

Rockets provide a remarkable example of the pitfalls of technology transfer for the Soviets because they *were* able to transfer people in this case. After World War II, they imported much of Nazi Germany's rocket industry—scientists, engineers, hardware, and plants. However, the Soviets have neglected to develop their own talent in this field and have let their early imported lead evaporate.

Current concern about technology transfer is misplaced. If the Soviets try to rely on it, they will only delay their own technological maturity. Moreover, U.S. restrictions on disseminating research results to prevent technology transfer seriously crimp science and technology in this country. Ironically, these restrictions hamper progress most in the U.S. defense sector, where information is considered most sensitive. This is a clear case of burning down the barn to roast the pig.

The Western Advantage

The Soviets' great intellectual and material resources, coupled with their admirable persistence in attacking any problem, should make Americans wary of underestimating what they can do. Yet the usual tendency is quite the opposite. U.S. analysts often overestimate the Soviets' capabilities, especially in developing weapons. If the Soviets field a new tank, the U.S. Army feels the need to do the same. If they build a hundred fighting ships, the U.S. Navy must build ships also. If the Soviets build a six-meter single-mirror telescope, must U.S. astronomers do the same?

The Soviets concentrate on building large numbers of simple and crude systems to accomplish their military objectives because their technology is weak. It is patently foolish for U.S. defense leaders to copy this behavior. American strength in high technology makes the numerous and expensive Soviet tanks, ships, submarines, and helicopters vulnerable. Several soldiers, each armed with a sophisticated $10,000 antitank missile, can easily defeat any $2 million tank. The Pentagon should not plan to build more and bigger of whatever the Soviets choose to make; it should develop less expensive and more reliable smart weapons. As suggested by the Exocet antiship missile used against the destroyer *Sheffield* in the Falklands War, these weapons can be highly effective.

The many smart U.S. weapons already deployed or being developed, such as the RAAM and SADARM artillery-delivered tank killers, suggest a potential for profoundly revolutionizing warfare. With their ability to destroy large, expensive tanks, personnel carriers, and aircraft, these weapons will make it much more difficult to rely on mobile, offensive tactics. Forces will tend to remain in heavily armed positions and will depend on relatively static, defensive tactics. The Soviets are vulnerable to such a revolution because of their heavy historical commitment to using many large pieces of hardware for offensive strategies. And they would have great difficulty following a Western lead in high-technology systems.

The Soviets' lack of a broad high-technology consumer sector and their focus on an all-consuming military sector result in a serious weakness. The capitalist system has provided a veritable Eden of technology to serve the civilian economy, and this immense resource continually feeds the military arena. The Soviets have nothing comparable.

LOUIS LAVOIE is a military systems analyst at the Defense Systems Division of Honeywell, Inc. Trained as a physicist, he has written extensively on electronic and nuclear instrumentation. The ideas expressed in this article are his own and in no way reflect the official position of Honeywell.

MEDICARE

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and hospitals to care for a set number of Medicare patients in return for a fixed premium per enrollee. Medicare officials should also develop incentives for insurance companies to negotiate similar contracts with HMOs and physician-hospital networks. Most insurance companies simply process Medicare claims; they do not bear any underwriting risk for Medicare patients. The revised policy would make carriers—along with doctors and hospitals—responsible for keeping prices below the contracted fee for services. This would lead to significant cuts in costs.

To keep the new system working, DRG rates must be updated regularly. They should cover the full costs of only those new technologies that will be cost-effective in the long term. For example, careful analysis of a technology must show that short-term savings will not be offset by increased admission rates. If frequent use of PTCA leads to more double admissions, the DRG system should not pay for the technique.

By the same logic, DRG prices should fully cover technologies that raise the cost per hospitalization but that lower long-term costs. The Rand Corp. recently analyzed a number of expensive tests designed to clarify the cause of gastrointestinal problems before stomach and esophageal operations. Curtailing such tests might reduce costs per case but also might lead to poorer choices on the type and technique of surgery. That, in turn, could lead to postsurgical complications, more hospitalizations, and higher costs, not to mention poorer health.

Thorough studies to establish the precise costs of efficient, high-quality care are crucial. Only when we know the true costs of treating health problems will we be able to set payment rates that do not encourage surgery and properly compensate for quality care. Such unbiased rates are essential if Medicare policy is to avoid a drift toward procedure-oriented medicine instead of treatment that incorporates human interaction, personal care, and good clinical judgment.

In sum, today's DRG payment plan may increase hospital admissions and shift costs to outpatient settings, offsetting any cost savings that might otherwise result. The existing plan should be viewed only as the first generation in a continuum of innovations in the American health-care system. □

COWEN

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of the giant chemical company ICI, says a survey by his company of where to look for science-based innovations produced "some evidence that the United Kingdom is sliding in the world pecking order." As a result, he says, ICI has increased its "links with overseas universities."

I find it easy to agree with domestic critics who insist that the British government has embarked on a self-defeating course. Its perceptions seem somewhat at odds with those of the Reagan administration, which has strengthened support for basic research in some areas. For instance, the administration has increased funding for high-energy physics partly because it believes this field provides a good environment for educating creative scientific talent. However, the current administration has also made some cuts in basic research in anthropology, psychology, and other social sciences.

The United States can draw other lessons from the current crisis in Britain. The journal *Nature*, for example, has repeatedly noted that universities have let their contacts with Parliament and government ministries lapse. Peter Brooke, undersecretary to Sir Keith Joseph, Britain's secretary of state for education and science, says his department has received only a handful of letters from scientists expressing their concern over the state of British research.

British scientists need to do more than sound the alarm within their own community. They need to communicate directly with members of government, as Brooke suggests. The Royal Society has made the same point, urging scientists to learn to communicate better with the government and the voting public about their work, their values, and their concerns.

U.S. scientists would do well to heed such advice. As they confront issues such as university involvement in the Strategic Defense Initiative, they should not leave sole responsibility for articulating their concerns to lobbying groups such as the Federation of American Scientists, or to scientists who are accustomed to speaking out on such subjects. U.S. representatives and senators often say they would welcome hearing from the less visible scientists as well. As Peter Brooke observed, when it comes to making science-related public policy, "The educational process cannot be abdicated by the scientific community." □

Silent partners in world health

Recent triumphs in the field of tropical medicine will soon be celebrated in "Quest for the Killers," a documentary series to be aired nationally on PBS in September 1985. One program will describe the fight against a worm infestation called schistosomiasis on the island of St. Lucia in the Caribbean.

Schistosomiasis affects as many as 200 million people in Africa, Asia, the Middle East, Puerto Rico and Latin America. It is often called "snail fever" because at one stage of their life cycle, *Schistosoma* worms infect snails that live on the bottom of rivers and streams. These parasites invade the skin of humans who drink, wash or swim in contaminated waters. They can cause severe itching, fever, diarrhea, and eventually irreversible damage to the liver. For 16 years, researchers visiting St. Lucia have been testing the practicality of various methods of control. Three approaches have proven to be most effective.

First, a public health team sprayed the rivers and streams of St. Lucia to get rid of infested snails. New plumbing facilities were constructed to assure a supply of uncontaminated water. Finally, treatment of people carrying the parasite was greatly facilitated by a drug developed and supplied by Pfizer. While previous treatments had to be given by injection, this drug was given orally only once, making it much simpler to reach a large number of people. The total control and elimination of the parasite is not yet a reality, but this combined medical and environmental program has done much to make life better for the people of the island.

Developing a drug such as this is a significant task that takes a decade or more and tens of millions of dollars. It generally involves the synthesis of hundreds of compounds in the organic chemistry laboratory. These compounds are then screened for antiparasitic activity. If one or more of them shows promise, the next step is to do toxicity studies and learn all about how the potential new drugs behave in laboratory animals. Only after completion of extensive, time-consuming animal studies can the drug be tested for safety and effectiveness in humans. And clinical trials in human patients can last for several years.

If the clinical trials indicate that the drug should be made available, new technology must be developed to produce it on a mass basis, and in cases like this, with little if any profitability for the developer.

Drug research and development isn't always "good theater." And it's largely a team endeavor generally without charismatic heroes. The days of Paul Ehrlich and his "magic bullet" are long past. The work of the pharmaceutical industry isn't usually the stuff of TV documentaries. But the drugs depicted in the various episodes came from the laboratories of pharmaceutical companies all over the world. The pharmaceutical industry has been the silent partner of government agencies, physicians, nurses and their associates who achieved public health miracles in St. Lucia and other developing countries.

In the Third World, pharmaceuticals are perhaps even more important than in advanced industrial countries. Often they are the only form of advanced medical technology which is practicable. Other forms of care, such as surgery, are often too cumbersome and too demanding of scarce resources. Drugs, by comparison, are portable, relatively inexpensive and comparatively simple to use.

The vast majority of drugs for the Third World and also for developed countries originate in the pharmaceutical industry. The government agencies do not have the broad expertise or resources for drug development, and medical schools and universities have different missions. Only the major research/pharmaceutical companies have the necessary skills and resources. Most manufacturers of generic drugs lack the research capabilities to create new drugs and test them for safety and efficacy. And that's only one reason an economically viable research-based pharmaceutical industry is important to all of us.

Pfizer is pleased to have been a partner in helping to reduce the hazards of one of the world's more widespread health problems. Pfizer is also pleased to have had an opportunity to help make it possible to tell this story. Therefore, we hope you will find time to watch "Quest for the Killers."

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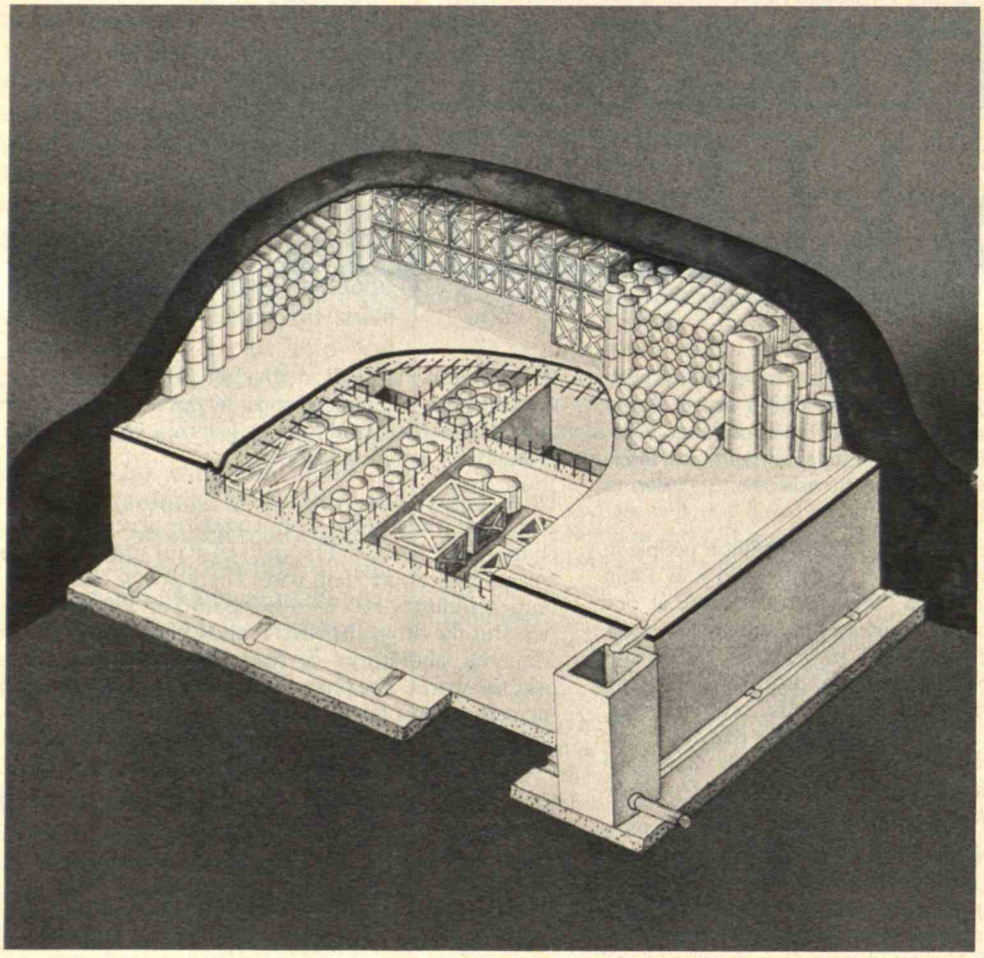
Radioactive Brinkmanship



This French design for land burial of low-level radioactive waste includes a waterproof vault for soluble material, carefully stacked containers of compacted waste under an impervious layer of clay, and vegetation to absorb rainwater.

Crisis politics will soon determine whether the nation will have new places to put its low-level radioactive wastes—or no places at all.

Congress set the stage for this confrontation in 1980. It mandated that by January 1, 1986, states must set up programs for local or regional disposal of low-level radioactive wastes, which states were then sending to one of only three approved sites in Barnwell, S.C., Richland, Wash., and Beatty, Nev. The idea was to force states to take responsibility for the waste they generate. (Nuclear power plants account for over 40 percent of this waste, with health-care institutions and suppliers, industry, and research universities contributing the rest.) However, the "not-in-my-backyard" syndrome, which motivated the governors of South Carolina and Washington to petition Congress in the 1970s for relief from storing everyone else's waste, has proved a stumbling block.

Thirty-three states have begun the process of finding new disposal sites. Each is a now a party to one of six regional compacts—states that have come together to locate and design regional disposal facilities. However, no group has finished the job—or even come close. And in the view of many other states, Massachusetts, the nation's fifth-largest generator of low-level radioactive waste, has made a mockery of the process. Its voters have approved a referendum requiring that a majority of them approve any disposal site in the state.

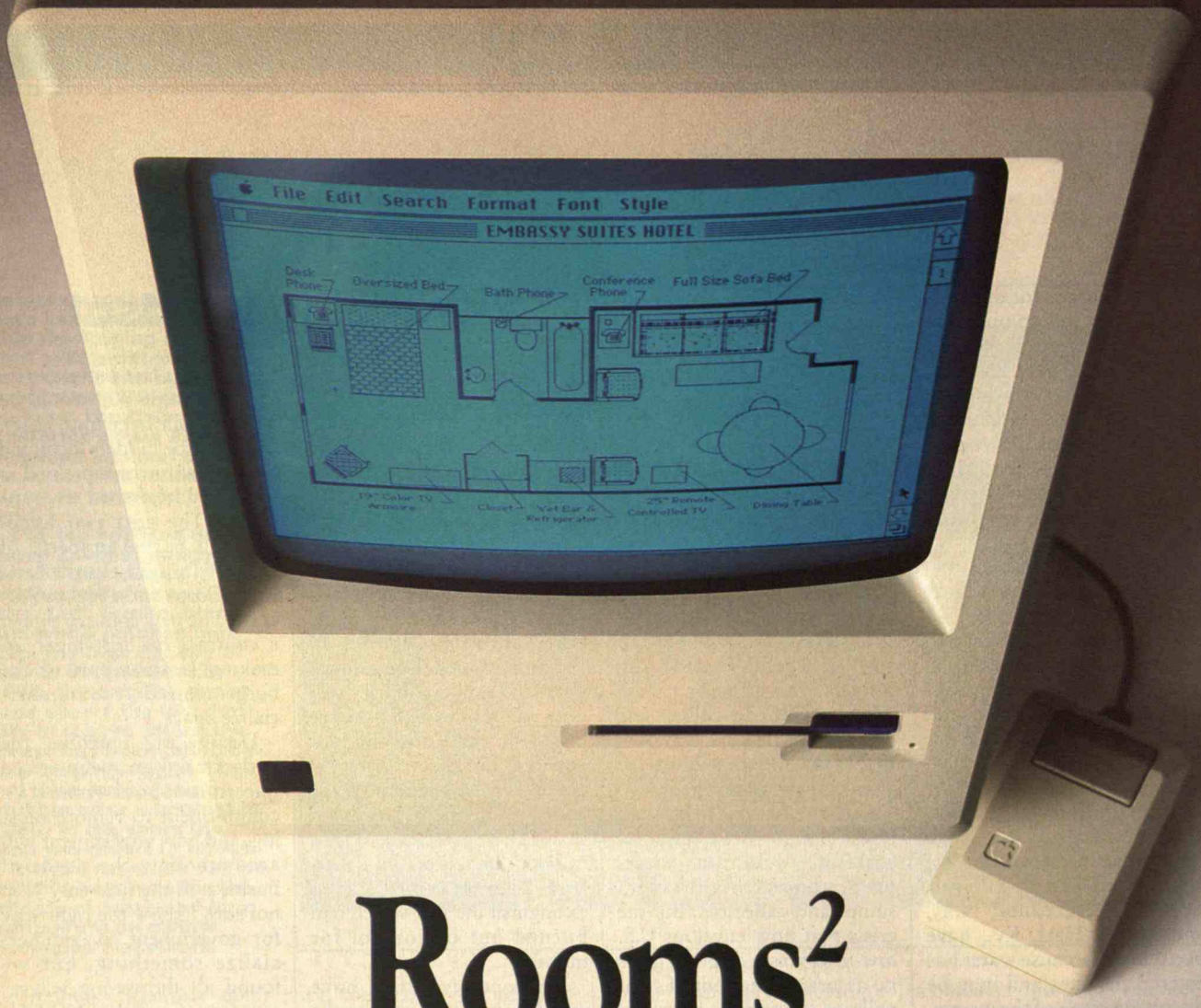
South Carolina, Washington, and Nevada now say they will call it quits. To enforce the will of Congress, say their governors, they will close their disposal facilities on January 1, leaving the nation's low-level waste to accumulate in its generators' backyards, where facilities are at best inadequate, and at worst nonexistent.

The temptation is for every waste generator to warn of potential disaster. For example, Michael J. Welch of Washington University in St. Louis says that even a brief waste-disposal moratorium could "impede breakthroughs in medical research for many years."

But M.I.T.'s Robert A. Alberty counsels a less strident approach—and in doing so joins the majority of the scientists, lawyers, and policymakers who chose the American Chemical Society's fall meeting in Chicago for a public forum. Given the political realities, they say, the 1986 deadline was not realistic, and no crisis should be assumed because it has slipped. The states—even including Massachusetts—are moving in good faith to meet their obligations, they say.

So a compromise is being fashioned, says Tim L. Peckinpaugh of the House Energy Research and Production Subcommittee: Congress will give the states another seven years—until December 31, 1992—to complete the regional disposal facilities, and the existing sites will continue to receive everyone's waste until then. Any state or group of states that falls behind an agreed-upon timetable for developing its new facilities will pay a surcharge on the nor-

ILLUSTRATION: AGENCE NATIONALE DES DECHETS RADIOACTIFS



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mal fees charged for disposal.

However, this compromise may not make its way through the House and Senate before Congress adjourns, warns radiologist William H. Briner of Duke University Medical School. Even if it does, the seven years is probably not enough, so history may repeat itself.

Through all of these maneuvers a central issue goes unheeded, says Frank L. Parker of Vanderbilt University: the question of how well existing sites are managing low-level wastes, and what standards should be required for future sites. When the program was established after World War II, six federal sites were designated to receive low-level civilian waste. One has since been filled. But two—at West Valley, N.Y., and Maxey Flats, Ky., have been closed because water has entered the sites and may be dissolving some of the wastes. In neither case have health hazards resulted, Parker insists, and he emphasized that there is no reason to expect future "catastrophic releases" from these sites.

However, the three sites that remain open follow essentially the same procedures West Valley and Maxey Flats used. Packages and drums of low-level wastes are placed in trenches with waterproof linings, which are then covered by soil and waterproof caps. If the packages are not full or stacked carefully, settlement is likely. This creates a trough where water can collect and eventually work its way into the waste, and finally into the environment as drainage.

European nations can boast of many better disposal systems, including waterproof concrete vaults with sumps and collectors. But the crisis that now envelops U.S. low-level waste disposal gives no assurance that out of sight will not continue to be out of mind.—*John Mattill* □

The disposal site for low-level radioactive waste at Maxey Flats, Ky., turned out to be hydrologically active, and it has been abandoned because water has seeped in.

Privatizing Landsat

Last spring was a historic time for Landsat, the 13-year effort by the National Oceanic and Atmospheric Administration (NOAA) to use satellites for remote sensing of the Earth. As fire threatened hundreds of exotic species on Ecuador's Galapagos Islands, computers at Purdue University in Indiana scanned the satellite's data—85 million bits per second—to cut through the haze of smoke and cloud and pinpoint the hot spots. Researchers at Purdue telephoned the coordinates of the fire's path to officials in Ecuador, who radioed firefighters on the island. They were then able to extinguish the fire, which had burned out of control for months.

The occasion may have saved Landsat as well as the island's remarkable ecology. Congress, the Commerce Department, the Office of Management and Budget (OMB), and communications firms had been locked in a battle over the transfer of Landsat operations to the private sector. The parties agreed that new private owners would require some money to get started—for launching two Landsat satellites and maintaining them into the nineties—but would eventually have to be self-supporting. Most of the firms bidding on the project wanted about $500,000. But the OMB considered that figure excessive and stood firm at $250,000. With the final settlement seemingly impossible to agree on, it looked as though there would be no appropriation in the 1986 budget.

But just as the Galapagos story was breaking, the parties forged a last-minute compromise: $286,000 would be parceled out over four years. Though six bidders dropped out, one survivor remained in the privatization sweepstakes. The next two Landsats will be the property of EOSAT, a joint effort of the RCA Corp. and Hughes Aircraft. The new concern signed a contract on September 26 making Landsat part of the burgeoning effort to commercialize space.

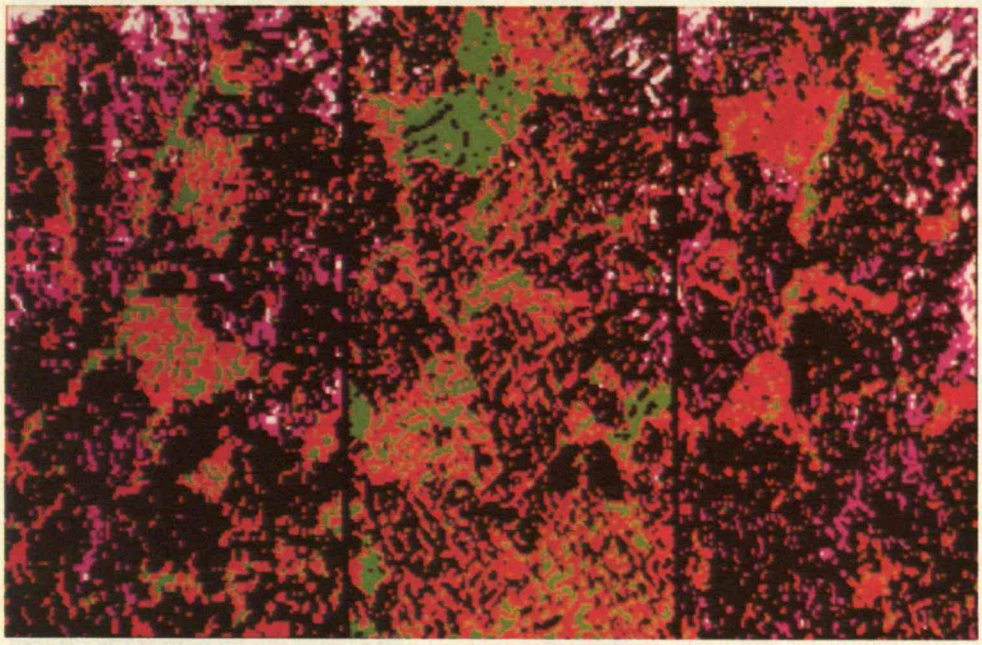
Despite this outcome, the budget brinksmanship raised questions about America's commitment to remote sensing, and how government will accommodate the needs of business in the heavens. "I'm not sure I know the right way for government to commercialize something, but we found all the wrong ways," says Cary Cravatt of NOAA's Landsat unit.

Too Slow

It remains to be seen whether EOSAT can survive. It needs a major infusion of private venture capital, and there is some concern that the long negotiations may have made investors leery. Even an EOSAT official says, "Private industry doesn't have $500 million to lay out." The government will have similar problems privatizing the space shuttle, the official adds: "No company is going to lay out enough money based on what are called 'potential markets.' "

An even greater concern is that the delays will almost certainly cause a data gap. Landsat satellites have a projected life of four years, but they don't always survive that long—*Landsat 4* lasted only

PHOTO: FRANK L. PARKER



Remote-sensing data from Landsat satellites help developing nations deal with problems such as drought and overpopulation. A team that includes the University of California's Paul Zinke has used Landsat data to measure population pressures on farmland in Thailand.

The top portions of these Landsat images show three stages in slash-and-burn agriculture. Left: Purple, black, and white patches indicate the high density of leaves in the forest in 1976. Center: The green area shows the low density of leaves where the forest has been felled before burning. Right: The red area indicates rice stubble after a harvest in 1980. In ten years the land will revert to forest.

Zinke's research can be used to help monitor the effects of slash-and-burn agriculture on similar ecologies elsewhere.

12 months. Scientists don't expect the current *Landsat 5* to fly much past 1987, nor do they expect to see a *Landsat 6* much before 1989. Should *Landsat 5* not last its projected life, or should unforeseen delays occur in the launching of *Landsat 6*, customers may face years without data.

Meanwhile, Landsat's foreign competitors will be ready. France is expected to launch its own version of Landsat—the government-subsidized SPOT satellite—during 1985, and Japan's MOS/LOS satellites should be ready for use sometime early in 1986. "The French have been unbeatable in marketing a program that isn't even in orbit yet," says Pierre Marie Adrien, a consultant to NASA on remote sensing. "No one can guarantee that they will not have their share of problems. But if everything goes right, users from the geological community will be interested in SPOT."

Troubled Hope

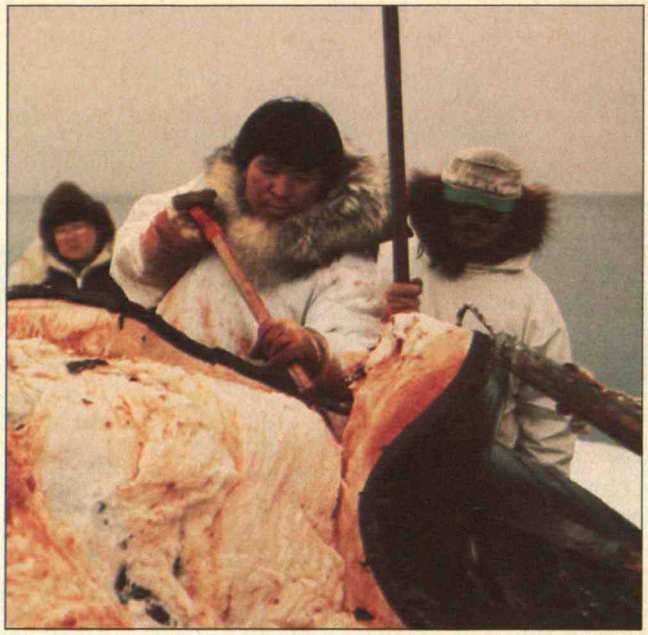
Sighs of relief from the Third World greeted the EOSAT deal. While the French and Japanese satellite programs could provide exclusive information to private firms, Landsat is a party to the U.N. "open skies" agreement, which guarantees all customers access to data. Remote sensing has been key in dealing with issues of overpopulation, drought, and uncontrolled urbanization for almost as long as Landsat satellites have been in orbit. For example, a Landsat census of Peru's vast aguaje palm forests, an important food source, helped the government set up a homesteading program to move slum dwellers from the crowded coastal plain to the underdeveloped interior. In Africa's famine-ridden Sahel, Landsat data have helped identify hidden water resources and chart the environmental effects of long-term drought.

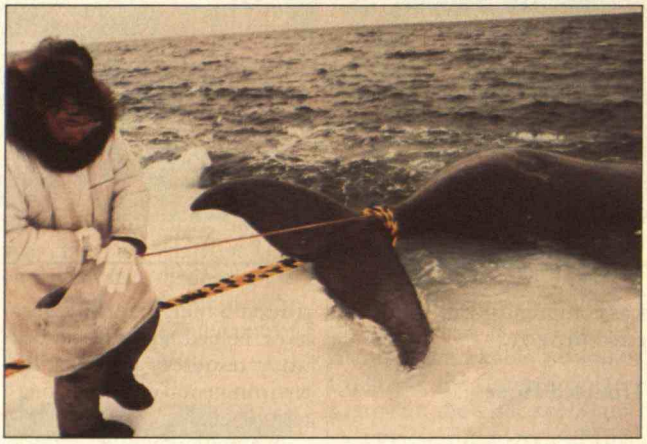
If it materializes, Landsat's data gap will hamper such efforts. "The value of Landsat is in its constancy," says the University of California's Paul Zinke. A team of researchers including Zinke has used Landsat data to measure population pressures on farmland in Thailand. The Thais use slash-and-burn agriculture: they burn off forest, plant rice, then allow the forest to reclaim old plots. To preserve a record of their land use, Zinke has compiled images of hundreds of plots as they progress through the cycle. Researchers could help protect similar ecosystems elsewhere by comparing Landsat images of them with Zinke's record. But Zinke's results can be used only with other Landsat data—not data from SPOT or another remote-sensing system.

The near-term success of EOSAT depends on congressional appropriations in three more budgets. These appear secure, but could be lost if the company seems to be in trouble. In the long run, the question is whether Landsat can thrive given the U.S. government's half-hearted support.

In contrast, the Japanese see remote sensing as a way to "realize global management of natural resources," says Adrien, and they are committed to promoting the technology. For example, their government has financed efforts to translate every known scientific paper on remote sensing into Japanese. Adrien believes the situation could be analogous to the colonization of the New World, when Spain and Portugal lost their early advantage to more aggressive powers.—*Joel Millman* □

How Hunters Are Saving the Bowhead Whale





Whaling is central to Inupiat culture, and North Slope Eskimos have turned to science to understand this resource.

Hunters speed across the frozen tundra in snowmobiles, dragging sleds heavy with freshly killed seals, ducks, and caribou. Meanwhile, Inupiat Eskimo whaling captains from nine Arctic communities meet to approve a program to use acoustical signals to count bowhead whales migrating through the ice in the Beaufort Sea.

Such an invocation of science and technology to retain the values of a traditional culture has few if any precedents among developing peoples.

The Inupiat's experience with science began in 1976, when the first mayor of their North Slope Borough (NSB), the late Eben Hopson, made a proposal to a conference sponsored by the American Association for the Advancement of Science: let the scientific community and the Inupiat set up a "cooperative, sharing relationship" so both could learn more about the Arctic. Then came a decision by the International Whaling Commission (IWC), a body unknown to most Eskimos, banning the hunting of the bowhead. The decision, supported by the U.S. government, shocked the Inupiat, who see the whale as a life-sustaining resource that is the focus of their communal life. The ban catalyzed them into moving on Hopson's idea and becoming astute supporters of innovative research.

Culture Shock by Fiat

The Inupiat angrily disputed IWC claims that the bowhead verged on the brink of extinction. The Inupiat claimed that thousands of whales were uncounted each year because the census on which IWC relied was inadequate. Carrying these arguments to Washington, Hopson succeeded in reversing the federal ban on Eskimo whaling and reluctantly agreed to a hunting quota. With Hopson's help, captains of nine Inupiat whaling communities united to form the Alaskan Eskimo Whaling Commission (AEWC). Today this organization manages the hunt, now approved by the IWC, under the authority of the National Marine Fisheries Service. It also sends representatives to IWC meetings as part of the official U.S. delegation. During 1984 and 1985 the IWC permitted the Eskimos to harpoon a total of 43 whales.

To make its point about the bowhead census, the AEWC sent teams of census takers 4 to 15 kilometers offshore to survey the narrow ice-free channels through which the bowhead make their northward spring migration. The watchers spent days scanning the sea in subzero temperatures, fog, and bitter winds, and the effort paid off. In 1976 some scientists believed the total bowhead population was as small as 700. But by 1985 the Inupiat's careful census led the IWC to accept an estimate of 4,400 animals.

But Inupiat hunters were still not satisfied. They said that many bowhead migrated unseen under the ice, breathing through small holes and air pockets. So in 1983 the NSB began sponsoring hydrophone studies in which researchers listened to the low-frequency moans that the bowhead herds make to maintain contact during migrations. Christopher Clark, a bioacoustic specialist from Rockefeller University, and his colleagues quickly concluded that the Inupiat were right. "We're hearing more whales than we're seeing," he said. When the techniques are perfected, Clark expects that he and his colleagues will be able to accurately estimate the population and know if it is maintaining itself, increasing, or decreasing. "I'm immensely impressed with the Eskimos," Clark says. The research is clearly a gamble for them because it could mean that their hunt is closed completely. But the Inupiat know that it will give them a better understanding of the biology of the bowhead.

The Inupiat's concern about the possible ill effects of offshore oil and gas activities on the bowhead whale has led the NSB to support research into other aspects of the animal and its environment. Studies of bowhead tissue donated by Inupiat whalers, for example, have begun to provide baseline data on concentrations of trace metals, chlorated pesticides, and petroleum hydrocarbons in these mammals. Dissection of bowheads' digestive tracts has shown that hairlike fibers in the mammal's mouth, called baleen, break off during feeding and are numerous in the stomach. This finding advances speculation that sticky material such as spilled oil or

PHOTOS: JOHN CRAIGHEAD GEORGE

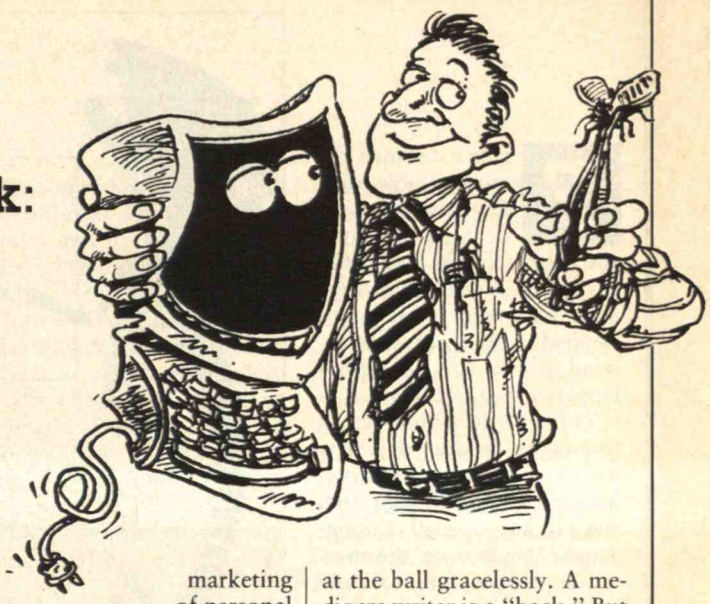
oil from contaminated prey could adhere to the fibers and form a potentially fatal "hair ball" in the narrow channel into the whale's stomach.

Examination of recently landed bowheads has raised another concern. The mammals' skins contain dozens to hundreds of eroded areas up to a few inches wide, each holding large numbers of bacteria. Thomas F. Albert, chief scientist of the NSB, suggests that oil might stick to these rough areas "like gravy to a tie," eroding the skin and leading to blood poisoning. Albert admits that "all this is very controversial." But he urges that the idea not be dismissed without study.

The NSB now spends more than $800,000 a year on whale research and reports its results at biannual conferences on bowhead biology. These meetings attract top whale scientists, hunters, marine experts, and wildlife and energy managers, including representatives of the IWC. The NSB's Science Advisory Committee is available to review this work—and to study other research on Inupiat concerns. "It is a model for the developing world," says Edward S. Ayensu, chairman of the African Bioscience Network.

The Inupiat are confident of their role in supporting Arctic research. Just last year their mayor, George N. Ahmaogak, Sr., told members of a National Academy of Sciences committee that as American citizens "we want to become more involved in research and policy decisions that affect us. We intend to move forcefully in whatever forums are available to us so that decision makers at all levels will be reminded that we have concerns and we want them addressed."—*John G. Blair* □

Computer Talk: User-Friendly Jargon



In the summer of 1945, U.S. Navy Lt. Grace Hopper and her colleagues at the Aiken Computation Laboratory at Harvard were rushing to finish the Mark II, one of the first large digital computers. Housed in a temporary building without air conditioning, the researchers kept the windows open. On a hot day, the Mark II stopped working. The scientists dove into the machine's innards and found the culprit: a moth beaten to death in a relay. Determined to document the cause of the computer failure, they pulled the insect out with a pair of tweezers and taped it into the log book.

Now a commodore, Hopper recalls that "We would tell (the project head) we were 'debugging' the computer."

Hopper's story, as she told it in *The Annals of the History of Computing*, has achieved the status of revealed truth among computer buffs. Whether it is truly why "debug" came into use as a computer term is another question. Ward Gilman, senior editor at Merriam-Webster in Springfield, Mass., doesn't question the accuracy of the story but dismisses it as "folk etymology." The terms "debug" and "getting the bugs out" were in use long before World War II, he notes.

Comprehensible Acronyms

Debug is but one of many computer terms that have gained popular currency over the past several decades. And in the last few years, the mass marketing of personal computers has unleashed a new wave of computer jargon. Bits, bytes, and microchips are as likely as real-estate prices to be discussed over cocktails.

Despite common complaints about new computer jargon, computerese is actually user-friendly. Unlike Latin-based biological words and Greek-derived theological terms, computer phrases are composed of commonplace English words; witness "input," "software," and "time-sharing." Moreover, computer acroynms (FORTRAN, JOVIAL, SMART) tend to be easier to use and remember than technical and secretive military abbreviations such as WWMCCS (World-Wide Military Command and Control System) and FOFA (follow-on forces attack).

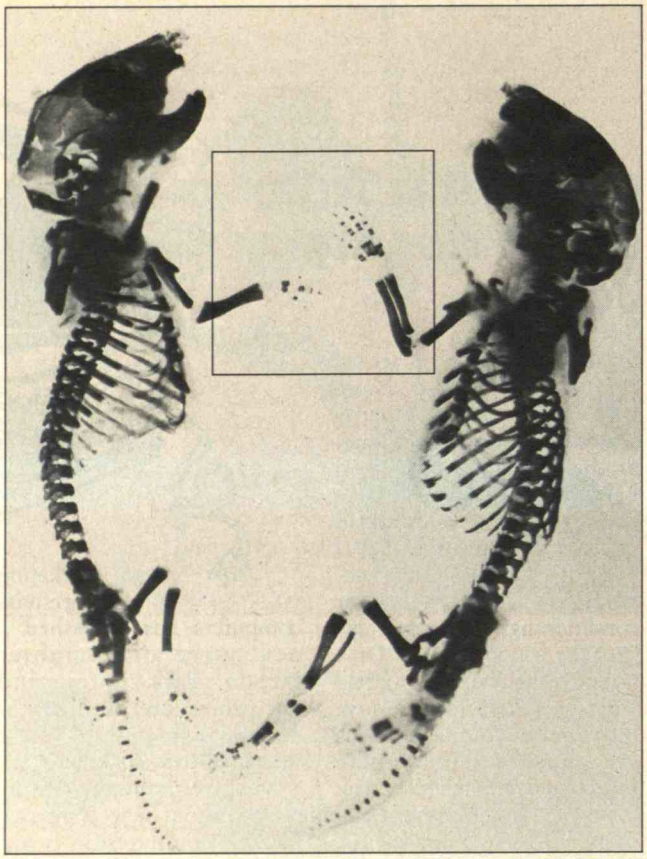
Some computer terms have been borrowed from other industries. "On-line," for instance, originally referred to a plant with direct access to a railroad line. Similarly, "down" refers to both a computer system that is not working and a production line that has been stopped.

"Hacker" is an old word that has gained a new meaning from its use by the computing community. In tennis, the word refers to an awkward amateur who "hacks" at the ball gracelessly. A mediocre writer is a "hack." But in computing, "hacker" has overcome its negative connotations, to indicate an expert programmer.

How did this transformation come about? In his book *Hackers*, Steven Levy suggests that the term arose when early computer users were trying to circumvent operating rules and locked doors in their quest for computer time. They saw their efforts as being in the M.I.T. tradition of pranks or "hacks" such as covering the campus's twin domes with foil. Though hackers used the term self-deprecatingly, Levy says, it also connoted artistry.

New computer jargon will no doubt continue to enter the everyday language. The Japanese may soon have their own version of Hopper's entomologically etymological story. In Japan the humming of computers seems to attract rats into the machines, where they chew on cables and urinate on connectors. A leading Japanese pest-removal firm has developed a high-tech rat trap that lures the hapless creatures with simulated squeaks in the 24-kilohertz range, gases them with carbon dioxide, and sucks them into a disposal container. Who knows what metaphor that contraption may inspire?—*Laura Simmons* □

ILLUSTRATION: JON McINTOSH



Mutant Mice: A Window on Human Development

From a distance, the mouse looks like any other furry rodent. But up close, you can see that its hind limbs are much shorter than normal, and that its feet are webbed with three toes instead of five. This mouse has flippers instead of legs.

This extraordinary creature is the product of a new technique that involves crossing the genes of different species. It has opened a long-sought window on the mysterious course of animal (and human) development, and on what happens when this process goes awry. Eventually, "transgenic" mice may help answer one of the most profound questions in biology: how does a single fertilized cell transform itself into a being with eyes, lungs, and a brain?

Scientists using this genetic-engineering technique have also created mice that are as big as rats. They are now working on developing transgenic farm animals—super-pigs that yield more meat per pound of body weight and super-cows that produce more milk. However, the scientists who do this pathbreaking work say there is no ethical or scientific reason to genetically engineer humans to have novel traits.

"I can't imagine a scenario where we do this type of research on humans," says Nobel laureate David Baltimore, a molecular biologist and director of the Whitehead Institute for Biomedical Research affiliated with M.I.T. "There are definite distinctions between animals bred for experimentation and humans, and those distinctions are not hard to make."

The technique that has given us mutant mice entails injecting a foreign gene into the nucleus of fertilized mouse eggs. The inserted gene ends up on a random spot of the mouse embryos' chromosomes—the long, stringy structures inside the nucleus of cells that carry all genetic information. Geneticist Philip Leder and his colleagues at the Harvard Medical School first used this technique to find out how a human gene that provokes cancer—an oncogene—does its dirty work. They injected a slightly modified version of an oncogene into the fertilized eggs of some mice. This yielded a family of tumor-prone mice and some important information about the oncogene's role in the development of breast cancer in mice. Scientists learned, for instance, that this oncogene was only one of several ingredients needed to cause cancer in these mice.

The researchers then decided to see what would happen if they mated the original mouse offspring—each of which contained the abnormal oncogene on only one set of chromosomes. Like humans, mice inherit two copies of every chromosome from their parents, and if there's a gene on one chromosome, there's generally an equivalent gene on the other. Each gene contains instructions for making proteins. A gene on one chromosome makes half the amount of protein needed for a given task—such as destroying bacteria—while its counterpart makes the other half.

Since the original animals in Leder's experiment contained only one abnormal gene, the other gene was still able to function normally, producing less of the required protein but enough to prevent a visible mutation. But when the scientists bred two of these "heterozygous" animals together, a quarter of their offspring inherited the abnormal oncogene in both sets of chromosomes—and they were born with deformed, flipperlike limbs. This deformity occurred because the cancer gene "fell into" the sequence of DNA that controls the normal development of the limb and disrupted its function. And because that disruption caused a visible mutation, scientists were able to figure out the function of the disrupted gene.

"Right now, when we see a defect—a human with six fingers, for example—we have no understanding of the molecular basis of that defect," says Leder. "This approach will help us understand it."

Why Humans Have Arms

The questions this research may someday answer are awesome. Why, for instance, do humans develop arms while dolphins grow flippers? Scientists already know that the gene for limb development that was disrupted in Leder's experiments is found in all vertebrate mammals, including dolphins. Perhaps this gene is turned on to a different extent in dolphins. Leder speculates, or perhaps it is not turned on at all.

"Ultimately, this research may tell us how a human embryo recapitulates with such exquisite detail the form that it was given genetic instructions for," says Leder. "It may also help us diagnose inherited deformities early in the embryonic development so we can offer genetic counseling to parents."

Transgenic mice have provided Rudolf Jaenisch, a molecular biologist at the Whitehead Institute, with some different clues to animal

PHOTO: PHILIP LEDER

Mice normally have two bones in their forelegs and five toes on their feet (right). By inserting foreign genes into mouse eggs, scientists have created mice with three toes and fused bones. The result is mice that walk on deformed, flipperlike legs (left).

development. A pioneer of transgenic research, Jaenisch inserted a viral gene known to cause leukemia into the DNA of fertilized mouse eggs. The offspring did indeed develop leukemia, but when they were mated again, an unexpected event occurred: 25 percent of their offspring died 12 days after conception.

Jaenisch discovered that the foreign gene had disrupted the normal gene for collagen, a key protein in the connective tissue or "glue" that holds the other tissues of the body together. "The walls of the mice embryos' red blood cells ruptured and they hemorrhaged," Jaenisch said. "So we learned that collagen is essential to the stability of blood vessel walls. More important, we now have a model to see exactly what collagen does in the development of an embryo."

Baltimore is using the insertional technique to answer an even more fundamental question: do cells "know" what they're doing? He has examined this question by inserting into mouse eggs a gene for antibodies, the proteins in the body's immune system that seek out invading viruses and bacteria. When mice (and humans) are conceived, the fertilized eggs contain genes for virtually every protein in the body. But these cells don't contain any antibody genes. They contain only genetic fragments that assemble into antibody genes as the fetus develops. But would the mouse eggs that contained Baltimore's artificially inserted antibody genes go ahead with this process of assembly, or would their cells "know" that their genes had been tampered with?

"These cells did not go blindly ahead and rearrange their genes," Baltimore says. "So we now know there is some sort of feedback regulation in cells."

What scientists learn about animal development and gene expression could be applied to human gene therapy—the process of inserting "good" genes into people with defective ones in the hope of treating illness. Blood disorders such as sickle-cell anemia, and certain immune deficiencies that leave infants without a natural defense against disease, may eventually succumb to such therapy.

However, human gene therapy does not involve inserting inherited traits that can be passed onto succeeding generations. And that is where most molecular biologists draw the line.

"Gene insertion in embryos is a very unruly way of studying development," Baltimore says, because scientists have no way of knowing where on the animal's DNA sequence the new gene is going to end up. "It's fine for experimental animals: we can make mistakes and learn a lot," Baltimore asserts. "But it's certainly not appropriate for human beings."

—*Alison Bass* □

Taxing Smokers

An analysis of Americans' smoking habits convinces Jeffrey E. Harris, associate professor of economics at M.I.T., that the controversial flat-rate cigarette tax is not as regressive as many economists have assumed.

Harris bases his conclusion chiefly on some unpublished data from the U.S. National Center for Health Statistics. Professor Harris finds, for example, that the highest prevalence of cigarette use is among middle-income Americans, and he is convinced that they bear the highest burden of existing cigarette taxes. Smoking is also most prevalent among middle-aged people—between 31 and 65.

Because fewer of them smoke, the tax burden falls least on Americans over 65. And because black smokers use fewer-than-average cigarettes, the burden falls less on blacks than on whites, Harris told a conference on smoking behavior and policy at Harvard's Kennedy School of Government early this year.

Of the 8-cent-per-pack additional cigarette tax imposed in 1983, Professor Harris said in summarizing his findings, an average of $15 a year has been paid by white Americans, $11 by blacks; $18 by middle-aged Americans, but only $6 by elderly Americans.

In terms of its effect on income groups, said Harris, "a cigarette tax increase is fairer than subjecting Social Security benefits to income taxation." And in terms of its racial impact, the cigarette tax is "fairer than cutbacks on government transfer programs targeted to minorities." □

Daedalus Reborn

If you think the human-powered flight across the English Channel by Paul MacCready's *Gossamer Albatross (see April* and *May/June 1981)* was hairy, how about this one: a team of M.I.T. students, faculty, and alumni are joining with the Smithsonian Institution's Air and Space Museum to plan a human-powered flight from Crete to Greece.

Project Daedalus would replicate the feat of the mythical Greek inventor of the same name, who flew 69 miles to freedom from Crete using wings he had fashioned himself.

The Daedalus technical team is based in the Department of Aeronautics and Astronautics, building on the experience of M.I.T.-built *Monarch*, winner of the 1984 Kremer World Speed Competition (*see May/June 1985*), and its predecessor, the 1979 *Chrysalis*. The feasibility study for Daedalus, underwritten jointly by M.I.T. and the Smithsonian, will be finished by early next year. If found feasible, the flight would be scheduled for the spring of 1987. □

Adversarial Experts

The adversarial system so effective in the legal environment is poisoning our political environment, says New Hamshire Governor John H. Sununu.

At an M.I.T. alumni conference last fall, Sununu, who graduated from the Institute in mechanical engineering 20 years ago, took policymakers to task for their acceptance of the "fairness concept"—the idea that every issue has two sides and that every policy can be set by listening to an equal number of experts on each side.

The trouble is, said Sununu, that the professionals who really understand a controversial issue are almost never divided 50-50—more likely 90-to-10 or 99-to-1. As a result, those who seek a balance find they have to rely repeatedly on a few witnesses for the minority view. Soon enough, said Sununu, whatever their real credentials, these minority witnesses become "experts" simply by virtue of their frequent appearances—"a cadre of incompetent expertise," he called them.

"This is a difficult concept to explain to people whose instinct and training tell them that 'even-handedness' is the only way to go," Sununu said. But he's convinced that "we have too much policy in this country distorted by the belief that the world is always 50-50." □

Regenerating Nerve

Surgically severed nerve tissue has for the first time been induced to regenerate—that is, regrow—by a polymeric material that has already proved its value in stimulating the regrowth of destroyed skin.

Reporting to the American Chemical Society last fall, Professor Ioannis V. Yannas of M.I.T. was jubilant: "The finding that both skin and nerve—two quite different tissues—can be guided towards regeneration by a polymer is of potentially great significance in all fields of surgery. It is conceivable," Yannas said, "that a wounded organ, whether wounded by trauma or elective surgery, can be induced to regrow its lost tissue components in their correct anatomical relationship."

Yannas prepares the polymeric materials by crosslinking collagen, the protein fiber, to a polysaccharide—a decomposable carbohydrate material. This polymeric establishes a pathway along which the tissue regrows. Nerve regeneration, following a pathway established by the

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CONTINUED FROM PAGE 87

polymeric in a tube, has occurred across the gaps of nearly three-quarters of an inch in laboratory animals, Yannas said. The tube and polymer eventually biodegrade and disappear.

Yannas believes that this is the first example of regeneration across such gaps "using nonneuronal materials produced by relatively simple procedures in the laboratory." □

Facing Up to the Low Cost of Giving

In three years starting in 1982, 2.5 billion pounds of the federal government's surplus food—cheese, butter, rice, nonfat dry milk, flour, and cornmeal—have been distributed to the needy. It is "the single positive initiative of the Reagan administration (in response) to the hunger crisis," says Professor Michael Lipsky of M.I.T.

But now the program is foundering for lack of the modest funds to meet distribution costs. New Jersey, New Hampshire, and Vermont have dropped out entirely, and food orders from other states have decreased, Lipsky says.

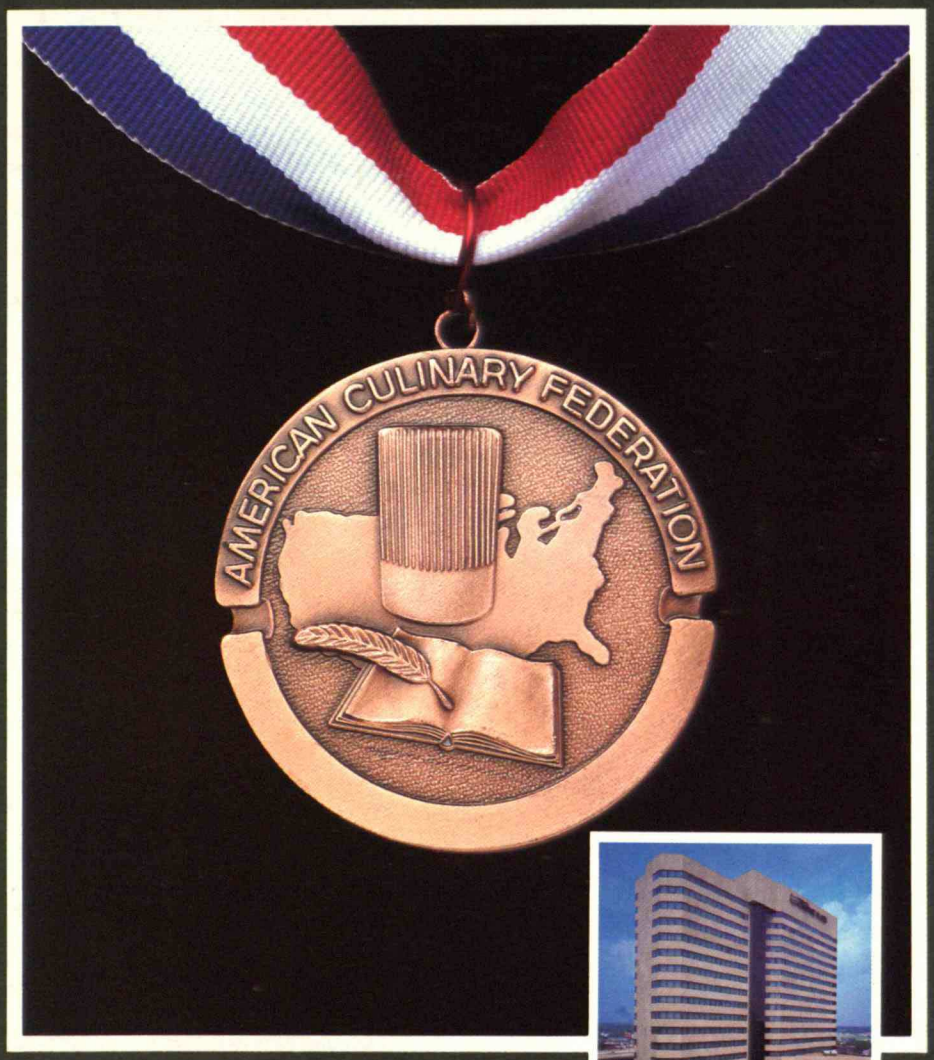
The surplus food has gone to food banks, church groups, and other community agencies throughout the United States who gave it to the needy. The agencies' direct distribution costs are reimbursed from federal funds. But the $50 million a year appropriated in fiscal 1984 and 1985 was inadequate, and 30 states have reported funding shortfalls, says Lipsky.

Meanwhile, according to Lipsky's calculations, the four-year old program has saved some $70 million in government storage costs.

Lipsky's recommendations: increase by at least 30 percent the administrative funding; simplify accounting and payment systems; and give local agencies more autonomy in determining recipients. □

Fluids on Video

A new video course in fluid dynamics by Professor Ascher H. Shapiro is now ready for distribution from M.I.T.'s Center for Advanced Engineering Study. There are 39 high-quality color videotapes, problems sets and solutions, and extensive background materials. Shapiro is Institute Professor at M.I.T., a recognized authority in aerodynamics, hydraulics, and propulsion engines. For further information: Carolyn B. Johnson, CAES, (617) 253-7444. □



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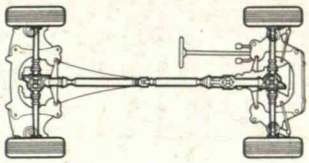

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